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AVIATION SAFETY LETTER

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Learn from the mistakes of others;
you'll not live long enough to make them all yourself ...

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What's New: Please visit the Civil Aviation Web site to view the online Risk-based Business Model and Risk Management Principles presentation:
www.tc.gc.ca/CivilAviation/risk/Breeze/menu.htm.

GUEST EDITORIAL

It is my pleasure to contribute to the *Aviation Safety Letter* (ASL). This quarterly publication is a major element of the Civil Aviation Directorate's overall communications strategy, and has the potential to help all of us see how our own responsibilities mesh with those of our colleagues in other branches. Such a broad viewpoint is essential as we move into the more integrated world of safety management.

In preparation for the organizational changes that will position the Directorate to better deliver its programs in the new safety management environment, the role of the Aircraft Maintenance and Manufacturing Branch is currently changing to one in which it will form a part of a larger standards developing unit, concerned not only with maintenance and manufacturing standards, but also with those relating to commercial and business aviation, airports, and air traffic services (ATS). However, this is an ongoing process, and my colleagues have already covered some of these functions in other editorials, so at this time I will restrict myself to the traditional role of the Branch within the Civil Aviation Directorate.

The Aircraft Maintenance and Manufacturing Branch consists of approximately 40 staff in headquarters, and a further 280 staff distributed across the regions. The Pacific, Prairie and Northern, Ontario and Atlantic Regions each have a Manager of Maintenance and Manufacturing, while the Quebec Region, because of the concentration of manufacturing activity in the Montréal area, has separate managers for the maintenance and the manufacturing functions. The Branch is primarily responsible for the development and application of regulations and standards related to the production and maintenance of aeronautical products, and their oversight in the field. That includes not only the performance of maintenance by approved maintenance organizations (AMO) and aircraft maintenance engineers (AME), but also the management and scheduling of maintenance by aircraft owners and operators. It encompasses such things as air operator technical dispatch requirements, the licensing and training of AMEs, the approval of aircraft maintenance schedules, and the oversight of industry activities related to these areas.

Like other branches, we are currently involved in the introduction of safety management systems (SMS) in accordance with the civil aviation strategy outlined in *Flight 2010*. Like those other branches, we too have our own unique challenges in this regard. On the one hand, because of our long experience with quality assurance (QA) programs, we have a head start on some of the QA aspects of safety management. On the other hand, most of this experience was with the reactive aspects of QA, and was focussed primarily on the actual man-machine interface. Only recently have we been involved with the subtleties of human and organizational relationships, and proactive hazard identification across a wider organizational spectrum. Also, some of the forward-looking program improvement elements of flight safety programs are new to us. In this respect, the addition of expertise from other branches will be particularly welcome, which provides a good illustration of the way in which the new organizational structure will support this new, more integrated approach to safety management.

These truly are exiting times for our industry, and together with all of the staff of the Aircraft Maintenance and Manufacturing Branch, I look forward to working closely with our colleagues from the other specialty areas to deliver a truly effective, coordinated, Civil Aviation Program.

I invite you to take a look at the Aircraft Maintenance and Manufacturing Branch's Web site at www.tc.gc.ca/CivilAviation/maintenance/menu.htm.

D.B. Sherritt
Director
Standards

The importance of being prepared

Dear Editor,

I would like to share an experience with other aviators to show the importance of being prepared. I was a low-hour pilot with what I would consider average cross-country time. After careful planning and persuasion, I convinced my wife to fly with me from Toronto, Ont., to the U.S. east coast. The passengers on that flight included our one-year-old daughter.

I had booked a Cessna 182 from a local flying school, and completed a checkout flight and short written evaluation on the aircraft prior to the trip. I reviewed the aircraft documents and all appeared to be in order. I was unable to get a copy of the pilot operating handbook (POH) or the GPS manual (I was not familiar with a moving map GPS at the time) until the day before the flight. I had decided that I would spend as much time as possible "chesterfield flying" before the actual trip. I completed all of the flight planning, and flew the trip several times, confirming every action necessary to get us to our intended destination (about four hours). In addition to this, I spent another three hours going through emergency procedures for the 182. Having seen all of the preparation, my wife was becoming a little nervous! I assured her that accidents are extremely unlikely, but that I must consider all possible scenarios.

I took great care in ensuring that all of the baggage was weighed, tagged and properly loaded for security, and that we were within the operating limits of the aircraft for weight and balance. The flight from Toronto to Buffalo, N.Y., went well, then to Elizabeth City, N.C., for more fuel, and from there to Cape Hatteras, N.C. The ceiling was unlimited, and in fact it was a great day for flying. We requested flight following, which was granted to us for the flight as well. We were cruising at 7 500 ft, when there was a sudden radical vibration, followed by an immediate loss of power, followed by the right windshield getting covered with oil, and smoke entering the cockpit. My wife simply asked two questions: "What is going on," and, "are we going to be OK?" My answer was, "I don't know what is wrong, but I do know that we are going to be OK."

I declared an emergency and requested vectors to the nearest airstrip. The controller gave us vectors to a nearby grass strip, which was identified as being "right below us." The only thing below us was forest with not a blade of grass in sight. When taking my flight training, my instructor was consistently reminding me that I should always look for a place to land in the event of an emergency. I always took this advice, and in this case, I recalled a farmer's field that we had passed immediately prior to the emergency. I turned the aircraft 180° and there it was, about 2 mi. from where we were.

The short, soft field landing was successfully completed into a headwind, and we all climbed out of the aircraft. The State Trooper at the scene asked how I managed the land the aircraft safely. I said planning, training and "chesterfield flying."

The power loss and oil spill were caused by a massive failure of the rear cylinder on the right side. I never did get to the root cause of why the engine failed in such a severe manner, I'm just glad the outcome was a positive one.

Nick Bartzis
Toronto, Ont.

Words on Fuel Management...

Fuel management and system problem solving must be approached with a clear understanding of the fuel system. Air operators' pilot training syllabi should communicate all specific and appropriate system knowledge, with particular attention to fuel system anomalies. For instance, helicopter pilots must be aware that when a boost pump malfunctions, a loss of fuel pressure is observed, or an appreciable difference exists between the boost pump pressures, the fuel quantity gage may indicate an erroneous fuel quantity and appropriate action(s) must be taken. They should also be aware that, should a fuel boost pump caution light be followed by a 'FUEL LOW' caution light, it would be prudent to land without delay at the nearest suitable area at which a safe approach and landing is reasonably assured.

Clarification—Blackfly Air Article in ASL 1/2007

The third paragraph of the article "Blackfly Air on Fleet Expansion" on page 11 of the *Aviation Safety Letter* (ASL) 1/2007 incorrectly implied that the principal operating inspector was the only appropriate person for operators to call at Transport Canada in order to discuss regulatory requirements associated with a fleet expansion. In fact, the article should have suggested that **operators may contact any of their Transport Canada principal inspectors to assist in discussing these requirements.**

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Runway Safety and Incursion Prevention Panel

by Monica Mullane, Safety and System Performance, NAV CANADA

In 2005, NAV CANADA invited stakeholders to form an independent working group to oversee runway incursion-prevention activities in Canada. This was as a result of the dissolution of a previous group known as the Incursion Prevention Action Team (IPAT), co-chaired by Transport Canada and NAV CANADA.

In the course of its life, IPAT was tasked with implementing recommendations contained in reports on runway incursions produced by both Transport Canada and NAV CANADA. Following the successful adoption of these recommendations, it was decided not to extend IPAT beyond its April 2005, expiry date. NAV CANADA identified a need to continue oversight of runway incursion-prevention activities, and this resulted in the formation of the Runway Safety and Incursion Prevention Panel (RSIPP).

Membership in this multi-disciplinary group will remain open, but is normally composed of one primary and one back-up representative from NAV CANADA, the Canadian Airports Council (CAC), the Canadian Owners and Pilots Association (COPA), the Air Line Pilots Association, International (ALPA), the Canadian Air Traffic Control Association (CATCA), the Air Traffic Specialist Association of Canada (ATSAC), and the Air Transport Association of Canada (ATAC). Additional members include other aviation stakeholders identified by the panel, and observers with a direct interest in runway safety, such as the Transport Canada Aerodrome and Air Navigation Branch, the Transportation Safety Board of Canada (TSB), and technical specialists from stakeholder organizations.

The panel's mandate is to provide a forum for the exchange of safety-related information pertaining to the movement of aircraft and vehicles in the vicinity of the runway, with the aim of promoting runway safety and with a primary focus on the reduction in the risk of runway incursions.

The panel accepted the following International Civil Aviation Organization (ICAO) definition of runway incursion on April 27, 2006:

Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and take-off of aircraft.

This differs from the previous definition used by NAV CANADA, which defined a runway incursion as: *Any occurrence at an airport involving the unauthorized or unplanned presence of an aircraft, vehicle or person on the protected area of a surface designated for aircraft landings and departures.*

Differences to note:
ICAO uses "aerodromes" rather than "airports."
ICAO uses "incorrect" rather than "unauthorized or unplanned."
ICAO uses "landing and take-off of aircraft" rather than "aircraft landings and departures."

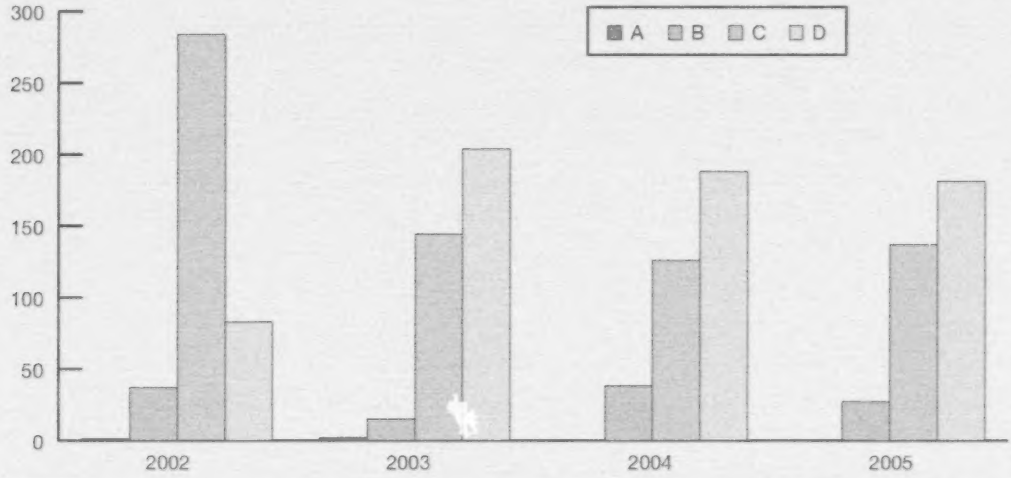
It should be noted that NAV CANADA tracks runway incursion statistics only at aerodromes where NAV CANADA provides services.

RSIPP activities include:

a) Reviewing the current runway incursion-prevention activities applicable to operations at Canadian aerodromes;
b) Reviewing international runway incursion-prevention activities with the objective of identifying and promoting proven best practices, where feasible;
c) Recommending methods for sharing safety information within the aviation community and suggesting runway incursion strategies/initiatives;
d) Sharing available runway incursion data to identify and analyze potential runway incursion safety issues or trends;
e) Making recommendations for runway safety and incursion-prevention to supporting agencies; and
f) Submitting an annual report that summarizes the findings, recommendations and accomplishments of the committee over the past year, for distribution to member organizations by panel members.

Runway incursion statistics

Runway incursions are classified as to the severity of the risk. Category A events are ones of extreme risk with instantaneous action required to avoid a collision. Very few runway incursions are Category A. In Category B incursions, there is a significant potential for collision. For example, action is required to prevent a vehicle entering a runway where an aircraft is cleared to land. Category C is similar to B, but there is ample time and distance to avoid a potential collision. Category D describes situations where there is little or no chance of collision. For example, this might be used to classify a situation where a vehicle proceeds onto a runway without permission, but there are no aircraft landing or taking off. Factors such as weather, speed of the involved aircraft, and time to take action are considered in a matrix in order to determine the risk. Chart 1 shows runway incursions in terms of the severity of the risk.



Severity	2002	2003	2004	2005
A	1	2	0	0
B	37	15	38	27
C	284	144	126	137
D	83	204	188	181
Total	405	365	352	345

All Runway Incursions by Severity

Chart 1

Runway incursions are also considered in terms of the source of the deviation. The current groupings are air traffic services (ATS) deviations, pilot deviations and vehicle/pedestrian deviations. Different approaches must be used to reduce these various types of deviations. Chart 2 shows a comparison of pilot deviations between Canadian-registered aircraft and foreign-registered aircraft in 2005.

Year	Quarter	Canadian	Foreign
2005	Q1	39	6
	Q2	39	10
	Q3	39	8
	Q4	24	7

Pilot Deviation—Canadian-Registered Aircraft versus Foreign-Registered Aircraft

Chart 2

All incursions involving ATS deviations are systematically investigated by NAV CANADA. These investigations provide detailed information as to the contributing factors in terms of ATS and are used to prevent further incidents.

In summary, the mandate of RSIPP is to provide a forum for the exchange of safety-related information pertaining to runway incursions, with the aim of promoting runway safety. △

Thoughts on the New View of Human Error Part III: "New View" Accounts of Human Error

by Heather Parker, Human Factors Specialist, System Safety, Civil Aviation, Transport Canada

The following article is the third in a three-part series describing some aspects of the "new view" of human error. (Dekker, 2002) This new view was introduced in issue 3/2006 of the Aviation Safety Letter *(ASL) in an interview with Sidney Dekker. The series presented the following topics:*
Thoughts on the New View of Human Error Part I: Do Bad Apples Exist? (published in ASL 4/2006)
Thoughts on the New View of Human Error Part II: Hindsight Bias (published in ASL 1/2007)
Thoughts on the New View of Human Error Part III: "New View" Accounts of Human Error

"New View" Accounts of Human Error

The "old view" of human error has its roots in human nature and the culture of blame. We have an innate need to make sense of uncertainty, and find someone who is at fault. This need has its roots in humans needing to believe "that it can't happen to me." (Dekker, 2006)

The tenets of the "old view" include (Dekker, 2006):

- Human frailties lie behind the majority of remaining accidents. Human errors are the dominant cause of remaining trouble that hasn't been engineered or organized away yet.
- Safety rules, prescriptive procedures and management policies are supposed to control this element of erratic human behaviour.
- However, this control is undercut by unreliable, unpredictable people who still don't do what they are supposed to do.
- Some bad apples keep having negative attitudes toward safety, which adversely affects their behaviour. So not attending to safety is a personal problem; a motivational one; an issue of mere individual choice.
- The basically safe system, of multiple defences carefully constructed by the organization, is undermined by erratic people. All we need to do is protect it better from the bad apples.

What we have learned thus far though, is that the "old view" is deeply counterproductive. It has been tried for over two decades without noticeable effect (e.g. the Flight Safety Foundation [FSF] still identifies 80 percent of accidents as caused by human error); and it assumes the system is safe, and that by removing the bad apples, the system will continue to be safe. The basic attribution error is the psychological way of describing the "old view." All humans have a tendency, when examining the behaviour of other people, to overestimate the degree to which their behaviour results from permanent characteristics, such as attitude or personality, and to underestimate the influence of the situation.

"Old view" explanations of accidents can include things like: somebody did not pay enough attention; if only somebody had recognized the significance of this indication, of that piece of data, then nothing would have happened; somebody should have put in a little more effort; somebody thought that making a shortcut on a safety rule was not such a big deal, and so on. These explanations conform to the view that human error is a cause of trouble in otherwise safe systems. In this case, you stop looking any further as soon as you have found a convenient "human error" to blame for the trouble. Such a conclusion and its implications are thought to get to the causes of system failure.

"Old view" investigations typically single out particularly ill-performing practitioners; find evidence of erratic, wrong or inappropriate behaviour; and bring to light people's bad decisions, their inaccurate assessments, and their deviations from written guidance or procedures. They also often conclude how frontline operators failed to notice certain data, or did not adhere to procedures that appeared relevant only after the fact. If this is what they conclude, then it is logical to recommend the retraining of particular individuals, and the tightening of procedures or oversight.

Why is it so easy and comfortable to adopt the "old view"? First, it is cheap and easy. The "old view" believes failure is an aberration, a temporary hiccup in an otherwise smoothly-performing, safe operation. Nothing more fundamental, or more expensive, needs to be changed. Second, in the aftermath of failure, pressure can exist to save public image; to do something immediately to return the system to a safe state. Taking out defective practitioners is always a good start to recovering the perception of safety. It tells people that the mishap is not a systemic problem, but just a local glitch in an otherwise smooth operation. You are doing something; you are taking action. The fatal attribution error and the blame cycle are alive and well. Third, personal responsibility and the illusions of choice are two other reasons why it is easy to adopt this view. Practitioners in safety-critical systems usually assume great personal responsibility for the outcomes of their actions. Practitioners are trained and paid to carry this responsibility. But the flip side of taking this responsibility is the assumption that they have the authority, and the power, to match the responsibility. The assumption is that people can simply choose between making errors and not making them—independent of the world around them. In reality, people are not immune to

pressures, and organizations would not want them to be. To err or not to err is not a choice. People's work is subject to and constrained by multiple factors.

To actually make progress on safety, Dekker (2006) argues that you must realize that people come to work to do a good job. The system is not basically safe—people create safety during normal work in an imperfect system. This is the premise of the local rationality principle: people are doing reasonable things, given their point of view, focus of attention, knowledge of the situation, objectives, and the objectives of the larger organization in which they work. People in safety-critical jobs are generally motivated to stay alive and to keep their passengers and customers alive. They do not go out of their way to fly into mountainsides, to damage equipment, to install components backwards, and so on. In the end, what they are doing makes sense to them at that time. It has to make sense; otherwise, they would not be doing it. So, if you want to understand human error, your job is to understand why it made sense to them, because if it made sense to them, it may well make sense to others, which means that the problem may show up again and again. If you want to understand human error, you have to assume that people were doing reasonable things, given the complexities, dilemmas, trade-offs and uncertainty that surrounded them. Just finding and highlighting people's mistakes explains nothing. Saying what people did not do, or what they should have done, does not explain why they did what they did.

The "new view" of human error was born out of recent insights in the field of human factors, specifically the study of human performance in complex systems and normal work. What is striking about many mishaps is that people were doing exactly the sorts of things they would usually be doing—the things that usually lead to success and safety. People were doing what made sense, given the situational indications, operational pressures, and organizational norms existing at the time. Accidents are seldom preceded by bizarre behaviour.

To adopt the "new view," you must acknowledge that failures are baked into the very nature of your work and organization; that they are symptoms of deeper trouble or by-products of systemic brittleness in the way you do your business. (Dekker, 2006) It means having to acknowledge that mishaps are the result of everyday influences on everyday decision making, not isolated cases of erratic individuals behaving unrepresentatively. (Dekker, 2006) It means having to find out why what people did back there actually made sense, given the organization and operation that surrounded them. (Dekker, 2006)

The tenets of the "new view" include (Dekker, 2006):

- Systems are not basically safe. People in them have to create safety by tying together the patchwork of technologies, adapting under pressure, and acting under uncertainty.
- Safety is never the only goal in systems that people operate. Multiple interacting pressures and goals are always at work. There are economic pressures, and pressures that have to do with schedules, competition, customer service, and public image.
- Trade-offs between safety and other goals often have to be made with uncertainty and ambiguity. Goals, other than safety, are easy to measure. However, how much people borrow from safety to achieve those goals is very difficult to measure.
- Trade-offs between safety and other goals enter, recognizably or not, into thousands of little and larger decisions and considerations that practitioners make every day. These trades-offs are made with uncertainty, and often under time pressure.

The "new view" does not claim that people are perfect, that goals are always met, that situations are always assessed correctly, etc. In the face of failure, the "new view" differs from the "old view" in that it does not judge people for failing; it goes beyond saying what people should have noticed or could have done. Instead, the "new view" seeks to explain "why." It wants to understand why people made the assessments or decisions they made—why these assessments or decisions would have made sense from their point of view, inside the situation. When you see people's situation from the inside, as much like these people did themselves as you can reconstruct, you may begin to see that they were trying to make the best of their circumstances, under the uncertainty and ambiguity surrounding them. When viewed from inside the situation, their behaviour probably made sense—it was systematically connected to features of the their tools, tasks, and environment.

"New view" explanations of accidents can include things like: why did it make sense to the mechanic to install the flight controls as he did? What goals was the pilot considering when he landed in an unstable configuration? Why did it make sense for that baggage handler to load the aircraft from that location? Systems are not basically safe. People create safety while negotiating multiple system goals. Human errors do not come unexpectedly. They are the other side of human expertise—the human ability to conduct these negotiations while faced with ambiguous evidence and uncertain outcomes.

"New view" explanations of accidents tend to have the following characteristics:

- *Overall goal*: In "new view" accounts, the goal of the investigation and accompanying report is clearly stated at the very beginning of each report: to learn.
- *Language used*: In "new view" accounts, contextual language is used to explain the actions, situations,

context and circumstances. Judgment of these actions, situations, and circumstances is not present. Describing the context, the situation surrounding the human actions is critical to understanding why those human actions made sense at the time.

- *Hindsight bias control employed*: The "new view" approach demands that hindsight bias be controlled to ensure investigators understand and reconstruct why things made sense at the time to the operational personnel experiencing the situation, rather than saying what they should have done or could have done.
- *Depth of system issues explored*: "New view" accounts are complete descriptions of the accidents from the one or two human operators whose actions directly related to the harm, including the contextual situation and circumstances surrounding their actions and decisions. The goal of "new view" investigations is to reform the situation and learn; the circumstances are investigated to the level of detail necessary to change the system for the better.
- *Amount of data collected and analyzed*: "New view" accounts often contain significant amounts of data and analysis. All sources of data necessary to explain the conclusions are to be included in the accounts, along with supporting evidence. In addition, "new view" accounts often contain photos, court statements, and extensive background about the technical and organizational factors involved in the accidents. "New view" accounts are typically long and detailed because this level of analysis and detail is necessary to reconstruct the actions, situations, context and circumstances.
- *Length and development of arguments ("leave a trace")*: "New view" accounts typically leave a trace throughout the report from data (sequence of events), analysis, findings, conclusion and recommendations/corrective actions. As a reader of a "new view" account, it is possible to follow from the contextual descriptions to the descriptions of why events and actions made sense to the people at the time, to in some cases, conceptual explanations. By clearly outlining the data, the analysis, and the conclusions, the reader is made fully aware of how the investigator drew their conclusions.

"New view" investigations are driven by one unifying principle: human errors are symptoms of deeper trouble. This means a human error is a starting point in an investigation. If you want to learn from failures, you must look at human errors as:

- A window on a problem that every practitioner in the system might have;
- A marker in the system's everyday behaviour; and
- An opportunity to learn more about organizational, operational and technological features that create error potential. △

Reference:
Dekker, S., The Field Guide to Understanding Human Error, *Ashgate, England, 2006.*

COPA Corner—Did You Really Get All Your ADs?

by Adam Hunt, Canadian Owners and Pilots Association (COPA)

Every year, as part of the preparation for an aircraft's annual inspection, most diligent owners of certified aircraft will go to the Transport Canada (TC) Web site and search for the airworthiness directives (AD) that are applicable to their aircraft.

This is accomplished by clicking on "Airworthiness Directives" on TC's Continuing Airworthiness Web Information System (CAWIS) Web site, www.tc.gc.ca/aviation/applications/cawis-swimn/, entering the aircraft's registration into the search box, and then checking the AD list that the CAWIS system produces. Some ADs that come up will be old, non-repetitive ones that are already signed off, and others will be repetitive ones that need doing on a regular basis. The list also has to be checked for applicability, as not all ADs will apply to your individual aircraft serial number, but pretty quickly you can pare the list down to those that need doing.

Field maintenance on a Cessna 172

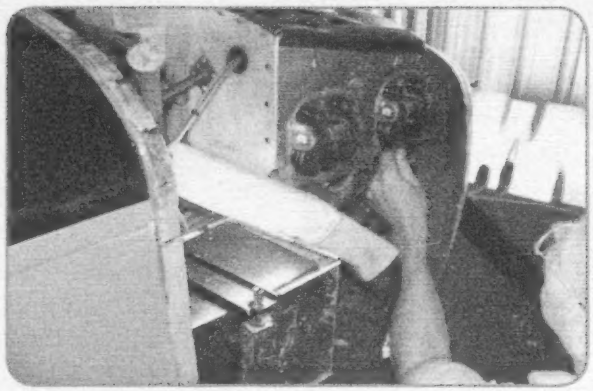
So, if you do that search by aircraft registration, you should get all the ADs for your aircraft, right? Wrong!

The list that you just searched will give you all applicable ADs for your airframe, engine and propeller. It does

not give you the ADs that are applicable to anything else, such as carburetors, seat belts or any after-market supplemental type certificate (STC) installed equipment, such as autopilots, doors or wing-tip fairings. Those items are contained in a separate miscellaneous equipment AD list. Because TC has no way of knowing which accessories are installed on your aircraft, you have to check this list to see which ones are applicable.

As of October 2006, there were 551 ADs on that list! Many are items like escape slides for airliners, but some are definitely equipment that could be found on small aircraft.

A good example is AD 96-12-22. This is a repetitive AD on Cessna engine oil filter adapters assemblies. These are commonly installed on any brand of aircraft (not just Cessnas) equipped with a Teledyne Continental Motors aircraft engine, including O-200, O-470, IO-470, TSIO-470, O-520, IO-520, TSIO-520, GTSIO-520, IO-550, TSIO-550 powerplants. It requires an inspection with the first 100 hr time-in-service and then every time the engine oil filter is removed. You won't find this AD without checking the miscellaneous equipment AD list.



Setting valve clearances

As well as doing a search by the aircraft registration, aircraft owners need to check the miscellaneous equipment AD list to make sure no ADs are missed. The miscellaneous equipment AD list on the TC CAWIS system can only be found by clicking on "Advanced Search" and then "All ADs" beside "List Miscellaneous Equipment ADs." You can find out more about COPA at www.copanational.org. △

Research Efforts on Survival Issues—Industry at Work

by Jason Leggatt, Engineer-In-Training (EIT), SAFE Association

The Survival and Flight Equipment (SAFE) Association is a non-profit, professional association, dedicated to the preservation of human life, and in particular, increasing survivability of those faced with the dangers associated with all aspects of recreational, commercial and military aviation.

Founded in 1956 as the Space and Flight Equipment Association, the name was changed to the Survival and Flight Equipment Association in 1969, to better reflect the immerging group of core members. Any ambiguity was dropped in 1976 when the name was finally changed to the SAFE Association. SAFE is headquartered in Oregon, but boasts an international group of members and maintains chapters through the world, most notably, regional chapters in the United States, SAFE Europe and, of course, the Canadian chapter of SAFE.

SAFE provides a common meeting ground for the sharing of problems, ideas and information. The Association's members represent the fields of engineering, psychology, medicine, physiology, management, education, industrial safety, survival training, fire and rescue, human factors, equipment design, and the many sub-fields associated with the design and operation of aircraft, automobiles, buses, trucks, trains, spacecraft and watercraft. Individual and corporate members include equipment manufacturers, college professors, students, airline employees, government officials, aviators and military life support specialists. This broad representation provides a unique meeting ground for basic and applied scientists, the design engineer, the government representative, the training specialist and the ultimate user/operator to discuss and solve problems in safety and survival.

SAFE's regional chapters sponsor meetings and workshops that provide an exchange of ideas, information on members' activities and presentations of new equipment and procedures encompassing governmental, private and commercial application in the field of safety and survival.

From August 29–30, 2006 the Canadian and U.S. East Coast chapters of SAFE hosted a joint meeting in Ottawa, Ont., to further promote the exchange of ideas between North American members. Government and industry experts briefed current programs, such as the ejection seat upgrade for the CF-18 Hornet. Aviation life support equipment and pilot flight equipment is also undergoing redesign and integration qualification to provide Canadian aircrew with state-of-the-art technology.

SAFE culminates each year's activities with the annual SAFE Symposium, which was held in Reno, Nev., the week of October 23, 2006. The Symposium is

attended by an international group of professionals who share problems and solutions in the field of safety and survival. Presentation topics ranged from cockpit design, restraint systems and injury reduction, on-board oxygen generation systems (OBOGS), improved personal protective equipment concepts, to the latest aircraft passenger egress aids, safety and crew training.

The proceedings of the Annual Symposium and other publications, such as journals and newsletters, are valuable reference sources for the professional involved in the fields of aviation safety and survival. For more information about the activities of the SAFE Association and regional and international chapters, please go to www.safeassociation.com. △

Deviations—Standard Instrument Departures (SID)

by Doug Buchanan, NAV CANADA

Many of our busier airports have published SIDs. Air traffic controllers issue these SIDs to pilots operating on IFR flight plans to ensure that there is IFR separation between the departing aircraft and other IFR flights. The use of SIDs allows pilots to know the departure routing in advance and reduces voice communication.

A review of incident reports has revealed an increase in SID deviations this year as compared to the average over the past three years. In many cases, pilots read back the SID as issued, but did not comply with the published SID and followed a different route. In most of these cases, there was a heading deviation, but there were also altitude busts. These all resulted in an actual or potential loss of IFR separation, which could lead to a collision.

Most SIDs are radar vector procedures that require further air traffic control action to get the departing aircraft to the flight-planned route. In the future, there will be more Pilot Navigation (Pilot Nav) SIDs that provide the most efficient path from the runway to the en-route structure.

Pilots are reminded to review each SID issued and to follow the procedure as published. If there are any questions, please ask for clarification.

The Transport Canada *Aeronautical Information Manual* (TC AIM) section on SIDs is being re-written to make it very clear as to what is expected of a pilot receiving a SID clearance. As well, contact is being made with specific companies that have a high proportion of deviations, to share these findings with them. △

Forest Fire Season Reminder!

Forest fire season is once again upon us, and each year there are aircraft violating the airspace in and around forest fires. This includes private, commercial and military aircraft. Section 601.15 of the *Canadian Aviation Regulations* (CARs) provides that no unauthorized person shall operate an aircraft over a forest fire area, or over any area that is located within 5 NM of one, at an altitude of less than 3 000 ft AGL. Refer to the "Take Five" originally published in ASL 3/99, which can also be found at www.tc.gc.ca/CivilAviation/SystemSafety/Newsletters/tp185/3-99/T5_forestfire.htm.

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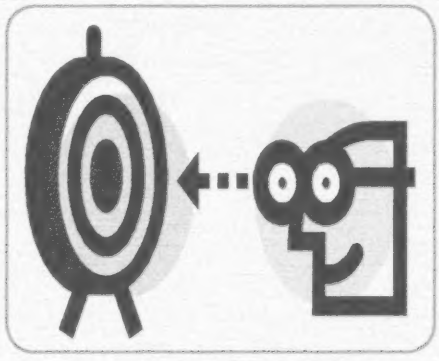
Aviate—Navigate—Communicate

by Captain Robert Kostecka, Civil Aviation Safety Inspector, Foreign Inspection, International Aviation, Civil Aviation, Transport Canada

"Aviate—navigate—communicate." This time-honoured axiom continues to be as relevant and instructive today as when it was first coined many decades ago. It succinctly sums up in three words the tasking priorities that are essential for a pilot to successfully handle any non-routine situation or occurrence. These priorities are equally applicable for all aircraft, from small, single-engine training aircraft, right up to large, transport category jets. This expression may have been coined in the early days by an enlightened (or frustrated) flight instructor in a J-3 Cub or Fleet Canuck, but it is more applicable than ever for the pilots of today's automated aircraft.



A distraction can divert the pilot's attention from primary tasks

It is easy to determine how distractions can occur in a single-pilot aircraft. The Federal Aviation Administration (FAA) determined, "that stall/spin related accidents accounted for approximately one-quarter of all fatal general aviation accidents. National Transportation Safety Board [NTSB] statistics indicate that most stall/spin accidents result when a pilot is distracted momentarily from the primary task of flying the aircraft."[1]

One of the first things that we learn as fledgling pilots is that improper airspeed management can lead to a stall. Nevertheless, data gathered from accident/incident investigations clearly shows how easily a stall can occur to experienced pilots who are distracted by one or more other tasks. Distractions can be almost anything—even some tasks considered routine—during normal operations: locating a checklist, retrieving something from behind your seat, looking up a frequency or other aeronautical data, or becoming engrossed in navigation calculations. The list is almost endless. These actions all have the potential to divert a pilot from the primary task of flying the aircraft.

The obvious conclusion is that learning how to prioritize effectively and not succumb to distractions is a tremendously important skill. "Through training and experience, you can learn to discipline your attention mechanisms so as to focus on important items."[2] Unfortunately, in the current environment, maintaining effective priorities and avoiding distractions is not getting easier.

Recent innovations like global positioning system (GPS) navigation and electronic flight instrument systems (EFIS) have brought tremendous sophistication to modern general aviation aircraft. But the latest avionics have also brought new potential hazards for pilots. In this environment, it is all too easy for the pilot to "remain heads down" for far too long. It is also possible for a pilot to become complacent and overly dependant on automated systems. This can cause the deterioration of basic skills.

The problem of distractions also exists in multi-crew aircraft. In this environment, the pilot flying (PF) must focus on flying the aircraft and must guard against allowing too much of his attention to be diverted by the tasks being performed by the pilot not flying (PNF). An excellent example of the consequences of distraction is the L-1011 that crashed into the Florida Everglades, killing all on board. The NTSB, "cited as a causal factor the diversion of the crew's attention to a burned out light bulb. The crew had been so intent on the bulb that they had not noticed the descent of their aircraft nor had they heard various alarms warning of their closeness to the ground."[3]

[1] FAA Advisory Circular No. AC 61-67B, Subject: Stall and Spin Awareness Training, p. ii
[2] *Human Factors for Aviation—Basic Handbook* (TP 12863), p. 38
[3] *Human Factors for Aviation—Basic Handbook* (TP 12863), p. 37

New technologies have created new opportunities for pilots to be distracted. The programming of the flight management system (FMS), or completion of an electronic checklist can lure the PF away from their primary task. It is all too easy for the electronic displays to divert one's attention. Remember that the various electronic displays can act like "face magnets." Make sure that you maintain situational awareness and don't allow yourself to get sidetracked.

A recent incident illustrated how easily distractions can result in improper airspeed management with serious consequences. The crew of a transport category jet was flying at flight level (FL) 400 and had been diverted west of their planned route. The pilot reduced thrust to slow the aircraft in anticipation of traffic delays. "The captain then focused attention to the flight management system (FMS) on the centre console to help the first officer determine fuel reserves for a possible hold."[4] While both members of the crew were occupied with the fuel calculations for a possible hold, the airspeed decreased and the stick shaker activated. "Both pilots pushed the control yoke forward to reduce the pitch attitude, which resulted in a descent and an increase in airspeed. This was followed by the crew returning the aircraft to a pitch-up attitude, with an increase in body angle of attack (AOA) and G. (*Author's note: For bodies undergoing acceleration and deceleration, G is used as a unit of load measurement.*) A second stick shaker activation occurred 11 seconds after the first. Buffeting and roll oscillations of about 10° accompanied the stick shaker events. The pitch attitude was further reduced and the airspeed recovered [...] The altitude stabilized briefly at FL 386 before the crew coordinated with ATC for a further descent to FL 380 due to conflicting traffic."[5]

Fortunately, there was no damage to the aircraft, or injuries to passengers or crew, and the flight landed safely without further incident. Had there been traffic below this aircraft, or had a similar airspeed mismanagement and approach to stall occurred close to the ground, the consequences may have been catastrophic. Incidents such as this serve to remind all of us of the need to focus on the essential priorities: *"aviate—navigate—communicate."*

To help us understand the critically important roles of the PF and PNF, let's review how the modern flight deck of a transport category aircraft evolved. In the last 60 years, from the post-war boom in air transportation until today, transport category aircraft have seen tremendous increases in their complexity, performance capabilities and size. At the same time, technological innovations have steadily reduced the number of flight crew members.

In the 1940s, an aircraft like the Boeing Stratocruiser would typically accommodate as many as 81 passengers and would cruise at 280 kt. Today, an A340 can carry more than 300 passengers and will cruise at 470 kt. The flight crew of a Stratocruiser consisted of five members: a radio operator, a navigator, a flight engineer, and two pilots. As the years progressed, improvements in electronics resulted in the radio operator no longer being needed. Long range navigation systems like inertial navigation systems (INS) eventually made navigators unnecessary. Ultimately, the two-pilot flight deck emerged during the early 1980s, when increases in system automation eliminated the need for a flight engineer. Today, virtually all transport category aircraft have only two pilots.

Photo of Boeing Stratocruiser courtesy of www.aviation-history.com, with permission.

Copyright Airbus; photographer H. Goussé.

Transport category aircraft have seen tremendous increases in their complexity, performance capabilities and size. At the same time, technological innovations have steadily reduced the number of flight crew members.

[4] Transportation Safety Board of Canada (TSB) Aviation Investigation Report A05W0109, p. 2
[5] Transportation Safety Board of Canada (TSB) Aviation Investigation Report A05W0109, p. 3

Copyright Airbus; photographer H. Goussé.

Modern two-crew flight deck

The two-crew flight deck brings certain challenges, which are especially apparent during periods of high workload. Depending on the circumstances, the PNF may also need to perform the functions of one of the crew members that was eliminated by advances in technology. For example, when an aircraft is being re-routed and it is necessary to calculate fuel reserves, the PNF takes on the responsibilities that were previously those of the navigator.

If an abnormal or emergency situation occurs, the PNF completes the appropriate checklists and essentially performs the tasks of a flight engineer. A problem can arise when the PF depends on automation and becomes overly involved in the PNF's activities. Adhering to the correct priorities will ensure that one crew member always focuses on flying the aircraft.

Simulators provide an outstanding tool for learning. In the simulator, we can safely gain first-hand experience with windshear, catastrophic engine failures, jammed flight controls, as well as losses of electrical and hydraulic power; things that we would never want to experience in a real aircraft. In addition to learning about technical issues, the simulator provides a powerful tool for learning about human factors. The simulator provides an excellent opportunity for us to learn the essential skill of prioritizing.

The primary task of flying the aircraft can never become secondary. There is nothing more important. Ultimately, we need to remain focused and maintain our priorities: *"aviate – navigate – communicate".* △

Prior to joining Transport Canada, Captain Kostecka worked as a pilot and instructor for several Canadian airlines. He has flown over 12 000 hr and holds a Class 1 Flight Instructor Rating as well as type ratings on the A320, A330, A340, B757, B767, CRJ, DHC-8 and B-25.

Flight Planning Issues

by Sydney Rennick, Civil Aviation Safety Inspector, Aerodromes and Air Navigation, Civil Aviation, Transport Canada

On page 29 of *Aviation Safety Letter* (ASL) 3/2006, Michael Oxner provided an excellent article on how VFR pilots can benefit from the use of "flight following" while flying in Canada. The air traffic services (ATS) system also provides an additional service by keeping an eye on the status or location of pilots who have filed a proposed flight plan. This is done in case an aircraft is overdue and it becomes necessary to alert the Canadian Armed Forces rescue coordination centre (RCC). Let's call this activity search and rescue (SAR) tracking.

While the treatment of IFR and VFR flight plans have many similarities, there are some differences. This article will address VFR flight plan activities.

The vast majority of pilots perform the correct actions regarding VFR flight plans; however, there are some pilots who are causing unnecessary workloads and occasionally misusing very scarce resources because they do not understand (or completely ignore) the proper procedures for opening, amending or closing VFR flight plans. Therefore, it would seem to be a good idea to review what should take place when a pilot files a VFR flight plan.

To begin, the pilot submits a VFR flight plan that contains a proposed time of departure and an estimated elapsed time en route. In Canada, and many parts of the world, the ATS system will begin SAR tracking based on the proposed departure time—this is done because there are circumstances under which the pilot departs from a remote location and the ATS system will not know the actual time of departure. This is the beginning of the safety net.

This differs from the United States, where the Federal Aviation Administration (FAA) does not start SAR tracking unless the pilot ***activates the flight plan*** on departure. Note that in Canada, the SAR tracking for a VFR flight plan will continue from the proposed departure time until a specified time, or one hour after the estimated time of arrival (ETA). At this prescribed time, if the location of the flight is unknown, the airplane is reported missing and a search for the "missing" airplane begins. Canadian Armed Forces RCCs, at various locations across Canada, are notified of the missing aircraft.

In some instances, SAR aircraft have been launched to look for a "missing" aircraft when, in fact, the pilot had

decided not to fly the proposed trip and ***did not cancel, close, or report changes to the VFR flight plan.***

Between February 2005, and February 2006, there were at least 96 incidents involving VFR flight plans. Problems arose for a variety of reasons. A breakdown of the incidents follows:

- 26 transborder flights arrived from the USA without a flight plan (the reasons are undetermined, but it may be that pilots failed to activate the VFR flight plan);
- 43 flights did not file an arrival report;
- 9 flights changed flight duration without notifying anyone;
- 3 flights filed flight plans by fax, but the pilot did not confirm receipt;
- 3 flights had pilots who changed aircraft without amending the flight plan; and
- 12 flights did not depart, and the pilot did not cancel the flight plan.

There may be good reasons for some of the errors noted above; however, it is very unlikely that every incident occurred for a good reason. Given that the Canadian topography and weather conditions can sometimes be quite harsh, I personally like the warm and fuzzy feeling I get from knowing that someone is watching over me who will alert an RCC in the event that I am forced to land or crash while en route and do not arrive at my destination at the scheduled time. Unfortunately, because of the scarcity of resources, it is possible that SAR aircraft would not be able to search for an actual downed airplane because they are looking for one or more of the "missing" aircraft described above.

We are very lucky in Canada to have an efficient and effective SAR tracking and activation service. In some countries, the cost of SAR activity is charged to the "missing" pilot—think about that! △

Safety Management Enhances Safety in Gliding Clubs

by Ian Oldaker, Director of Operations, Soaring Association of Canada (SAC)

Approximately one year ago, the Soaring Association of Canada (SAC) Board of Directors made the decision to implement a safety management system (SMS) at the national level. Although we have had a safety program in place for many years, an SMS would insert some additional safety-management methods; it would be based largely on the Transport Canada SMS for small operators. The SAC program includes a standard for improvements to existing club programs or the implementation of a new program.

Workshops were run across the country last spring, at which point the program was introduced and the participants were taken through the process of hazard identification and risk assessment for typical club operations. Although there were some questions about the value of this program at the time, clubs have had a positive attitude regarding the need for improvements. Club representatives were asked to return to their clubs and involve members in these tasks, which include a requirement to define strategies to address and reduce or mitigate the identified risks. If you, as a reader of this *Aviation Safety Letter* (ASL), have not been involved at the club level, or are unaware of this program, now is the time to act—before you flex your wings again at the start of the new soaring season. Start thinking of how you can contribute to a safer club environment, and hence safer flying operation; ask about the club's safety program, and how you can take part.

It is too early to attribute the excellent safety record for gliding in 2006 to this program, but a heightened awareness of the need to remain vigilant about hazards may have played a part. Hazard identification is one of the first essential tasks of this safety initiative, followed by the design of a club strategy to reduce the safety risks. There can be hazards in the following areas: **Administrative** (lack of emergency procedures), **Supervisory** (at the flight line), the **Safety Program** (poor feedback of lessons learned), **Airport/Airfield Infrastructure** (public access/signage), **Airport/Airfield** (poor overshoot and undershoot areas, grass cutting), **Pilots** (recurrent training/checks, advanced/cross-country training), **Pilot Experience** (efforts/strategies to maintain currency levels), **Weather Conditions** (flight planning and preparation for the anticipated conditions). You can probably think of more. If not, look back on past incidents and learn from them.

The SAC SMS and safety program are in their early stages of development. The relevant documents are available on the SAC Web site at www.sac.ca. △

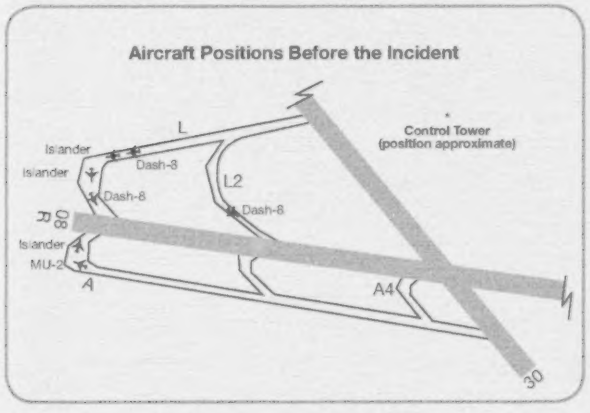
Near Collision on Runway 08R at Vancouver

by Glen Friesen, Senior investigator, Transportation Safety Board of Canada (TSB), Pacific Region

On October 29, 2004, a potentially catastrophic near collision occurred between a departing BN2P Islander and a taxiing Dash-8, on Runway 08R at the Vancouver International Airport. At 06:53 Pacific Daylight Time (PDT), the Vancouver tower south controller cleared the Islander for takeoff from the threshold of Runway 08R. The Islander was in the rotation for lift-off when it went by a Dash-8 that was partially on the runway, abeam the Islander's left wingtip, at Taxiway L2. The final report on this occurrence (TSB file A04P0397) was released on November 6, 2006.

Immediately prior to the occurrence, the tower controller had seven departing aircraft holding short for departure on Runway 08R and two on final. On the south side of the threshold, on Taxiway A (see illustration), was a BN2P Islander followed by a Mitsubishi MU-2. Opposite, on Taxiway L, was a Dash-8 followed by two more Islanders, and a second Dash-8. There was a third Dash-8 holding short of Runway 08R on L2. Taxiway L2 is also a high-speed exit for the reciprocal Runway 26L.

It was still dark; the visibility was 8 SM and improving. After the first Dash-8 on Taxiway L departed, the first arrival landed. The controller then cleared the Islander on Taxiway A to taxi to position and hold on Runway 08R and requested that the pilot move ahead to permit a Dash-8 to line up behind. The controller then cleared the Dash-8 (believed to be on Taxiway L) to take position behind the Islander, without realizing that the Dash-8 was down the runway at L2. Since the controller thought the Dash-8 and the Islander were both at the threshold of 08R, he did not state the specific entry point for either one, nor was he required to do so.



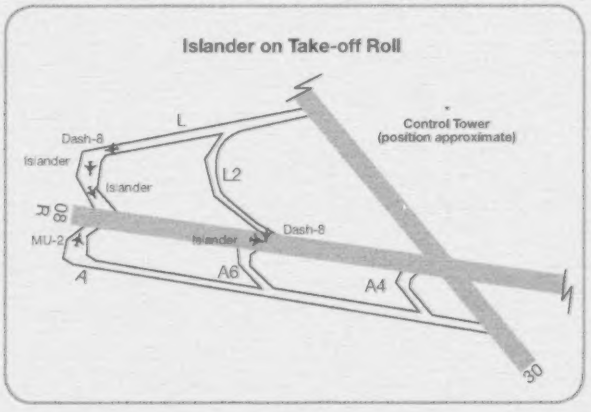
The Dash-8 crew at L2 apparently acknowledged their clearance to position; however, it was blocked by another transmission. The Dash-8 at L2 began taxiing toward Runway 08R, while looking ahead for the Islander it was to follow—which was in fact behind it.

After the blocked transmission, the controller asked who made the last call. A transmission came from "the Dash-8 behind the Islander," which matched the controller's mindset of the situation, but it was not the same Dash-8. A comment was made about the Islander's lights not working (there were still two more Islanders waiting to depart). A series of confusing and mostly unsolicited transmissions from unidentified sources took place regarding navigation lights on Islanders. It was during this series of transmissions that the Islander in position at the threshold of Runway 08R was cleared for takeoff and complied with that clearance.

As the Dash-8 at L2 was moving toward Runway 08R, the crew was still unable to see the Islander they were instructed to line-up behind, and became uneasy about the situation. The crew elected to turn the aircraft to their right, to look toward the threshold of 08R. They then saw the landing lights of the Islander coming down the runway on the take-off run. The crew stopped the Dash-8 and displayed all exterior aircraft lights as the Islander rotated in front of them.

Analysis—Following the routine pre-shift review and briefing, the controller was not aware that Taxiway L2 was open; on the controller's two previous night shifts, L2 had been closed for maintenance. When the controller scanned the departure flight progress strips for the taxiway designators assigned by the ground controller, it was not recognized that the digit "2" was partially obscured by other information for the one departure on Taxiway L2.

The airport control tower is equipped with airport surface detection equipment (ASDE). This ground surveillance radar system displays targets on the airport, but it has some inherent limitations and some unresolved technical anomalies. The tower controller did not rely on this system, and did not associate a target on Taxiway L2 with the Dash-8, or monitor the ASDE when the Dash-8 was cleared to position behind the Islander.



Prior to the incident, the controller was stating runway entry positions in all clearances onto the active Runway 08R, and these positions were being read back by flight crews. Although not a requirement for entry at the threshold, this appeared to be a common practice, but it ceased in the minutes leading up to this incident. In the specific take-off clearance leading to this occurrence, the controller did not state the runway entry position on 08R, nor did the Islander pilot voluntarily state it, which precluded the opportunity of alerting the Dash-8 at L2.

As a point of interest for all pilots departing from any entry location along a runway, controllers are required to specify the runway entry location at an intersection or taxiway other than at the threshold, which is mentioned in the Transport Canada *Aeronautical Information Manual* (TC AIM) RAC 4.2.5.

It is not a requirement for a pilot to read back or otherwise state their runway entry location; however, if pilots are aware of the controller's requirement, it would be reasonable to expect that a pilot would challenge the controller if the clearance onto a runway, not at the threshold, did not include the intersection name or taxiway location. Therefore, in theory, the Dash-8 crew could have noticed the absence of this requirement in the controller's clearance to line-up on 08R when they were at Taxiway L2.

It has been a long-standing argument that a common frequency allows pilots to maintain better situational awareness. Numerous aircraft were tuned in to the Vancouver tower south frequency. No one advised the controller that there was no Dash-8 at the threshold able to line up behind the Islander. It is unknown why the sole pilot of the Islander did not see the Dash-8 at L2 taxiing onto the runway ahead.

Following this incident, the Vancouver tower implemented an operations bulletin to remind controllers of the requirement to specify the name of the taxiway or intersection when issuing a clearance to position or for takeoff, other than at the threshold, and further recommended that the procedure be applied to the threshold as well. In the immediate term, the TSB is working with NAV CANADA and Transport Canada to encourage good airmanship practices to supplement this air traffic control (ATC) requirement and enhance safety while more permanent requirements are being considered. △

Say Again! Communication Problems Between Controllers and Pilots

by Gerard van Es, National Aerospace Laboratory (NLR), Amsterdam, The Netherlands

"Regardless of the level of sophistication that the air traffic system achieves by the turn of the century, the effectiveness of our system will always come down to how successfully we communicate."

Linter and Buckles, 1993

Voice communications between controllers and pilots are a vital part of air traffic control (ATC) operations. Miscommunication can result in hazardous situations. For instance, miscommunication has been identified as a primary factor causing runway incursions. The collision between two Boeing 747s at Tenerife in 1977, demonstrates the potentially fatal consequences of inadequate communication.

Each year, millions of transmissions are made between controllers and pilots. Most of these transmissions relate to instructions given by controllers, and the responses from the pilots to these instructions. Analysis of samples of pilot-controller communications recorded in different ATC centres revealed that some kind of miscommunication occurred in only 0.7 percent of all transmissions made. In more than half of these, the problems were detected and solved by the controller or pilot. These are very good numbers, considering the fact that at least two humans are involved in the communication process.

So what can go wrong? In order to answer this question, the National Aerospace Laboratory NLR conducted a study on air-ground communication problems, using recorded incidents in Europe. This study was commissioned by EUROCONTROL as part of their safety improvement initiative. Although this study was limited to the situation in Europe, many of the identified issues apply to other parts of the world (e.g. North America). The results of this study were published in two reports that can be obtained from EUROCONTROL (see the end of this article). This article will briefly discuss some of the important results from these studies.

The most typical communication problem identified was related to the so-called readback and hearback errors. These come in two flavours: one in which the pilot reads back the clearance incorrectly and the controller fails to correct the error (readback/hearback error), and the other in which the controller fails to notice his or her own error in the pilot's correct readback or fails to correct critical erroneous information in a pilot's statement of intent. The following is an example of a typical readback/hearback error: "the B737 was outbound from XX maintaining 6 000 ft. The Tu154 was outbound from YY, and on initial call to the KK sector, was cleared to 5 000 ft. However, the pilot read back the clearance as 6 000 ft, which was unnoticed by the

controller. A short term conflict alert (STCA) warned the controller of the situation, and avoiding action was issued to both aircraft." An example that illustrates a hearback error is the following: "the aircraft was cleared to descend to FL 150, but acknowledged a descent to FL 180. This was challenged by the controller, who then inadvertently cleared the aircraft to FL 130. This incorrect flight level was read back by the pilot, and was not corrected by the controller." Other typical problems found, were related to cases where there was a complete loss of communication, or there were problems with the communication equipment on the ground or in the aircraft itself. An example of loss of communications is the following: "a B777 was transferred from frequency 129.22 to the XX sector frequency, 134.77, and readback appeared to be correct. Approximately 5 min later, the XX sector controller telephoned to ask for the B777 to be transferred, and was informed that it had been. Subsequently, the B777 called frequency 129.22 to advise of having gone to the wrong frequency. The B777 was absent from the frequency for about 10–15min." Loss of communication in any form or duration is always a hazardous situation, but it is even more so after the 9/11 events.

What is causing all these problems? Like many safety-related occurrences, the answer is not simple, as there are a large number of factors that have played a role in the chain of events leading to air-ground communication problems. However, a number of factors really showed to be significant contributors to the problem. First, similar call signs on the same frequency was by far the most frequently cited factor. In such cases, pilots picked up an instruction intended for another aircraft that had a similar call sign. For the controller, it is not easy to identify this error, as the transmission may be blocked when two aircraft respond to the instruction. There were even a few cases in which four aircraft responded to the same instruction. The use of similar call signs should be avoided as much as possible. When this is inevitable, the following should be considered to mitigate the problem: pilots should use full calls signs (no clipping) in their readbacks; when there are similar call signs on the frequency, controllers should inform the pilots about it; pilots should actively monitor at critical flight stages using their headsets (instead of flight deck speakers). In Europe, the problem of similar call signs is being addressed by EUROCONTROL. Another important factor is related to frequency changes. In a large number of air-ground communication incidents analyzed, pilots forgot to change the frequency as instructed, or changed to the wrong frequency. Pilots should always check the selected frequency whenever the radio has gone unnaturally quiet in a busy sector. The NLR study identified many more factors, such as the use of non-standard phraseology (by controllers), radio interference, frequency congestion, and blocked transmissions. The vast majority of the factors identified are not new. Many of them have been there since controllers on the ground started to communicate with pilots using a radio.

In the future, some of the air-ground communication problems could be eliminated by the introduction of data link, for instance. However, such a system (and others) cannot eliminate all of our communication problems. △

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Checklist Actions After Engine Failure on Takeoff

An Aviation Safety Advisory *from the Transportation Safety Board of Canada (TSB)*

On December 20, 2005, an MU-2B-36 aircraft was taking off from runway 15 at Terrace, B.C., on a courier flight to Vancouver, B.C., with two pilots on board. The aircraft crashed in a heavily wooded area approximately 500 m east, abeam of the south end of Runway 15; about 300 m beyond the airport perimeter. A post-crash fire occurred. The aircraft was destroyed and the two pilots were fatally injured. The accident happened at 18:35 Pacific Standard Time (PST), in dark conditions. The investigation into this occurrence is ongoing (TSB file A05P0298).

To date, the investigation has revealed that the left engine (Honeywell TPE331-6-252M) failed as a result of the combustion case assembly (plenum) rupturing. This engine had accumulated 4 742 hr since the last continuous airworthiness maintenance (CAM) inspection. Investigation of the wreckage also revealed that the left engine was not delivering power and its associated propeller was not feathered at the time of impact. The flaps were also found at 20°, in the maximum deflection position. Tree damage revealed the aircraft had descended into the trees laterally, at a nose down angle of approximately 23°.

The following make up the checklist actions prescribed in the MU-2B pilot operating manual (POM) for an engine failure:

- Dead (failed) engine condition lever—EMERG STOP (to feather the propeller and shut off fuel at the fuel control)

- Dead (failed) engine power lever—TAKEOFF (to assist full feathering of the propeller)
- Landing gear switch—UP
- Flap switch—UP (after reaching a safe altitude and airspeed)
- Airspeed—BEST RATE OF CLIMB (150 kt calibrated airspeed [CAS])
- Trim ailerons—SET (to ensure no spoiler extension and loss of lift)
- Power (operating engine)—MAXIMUM CONTINUOUS POWER

The POM for the MU-2B permits takeoff using either flap 5 or 20. The advantage of using flap 20 for takeoff is that the aircraft will become airborne sooner; however, because of the greater drag caused by the higher flap setting, the aircraft's climb performance will be reduced.

If one engine fails after takeoff, the resulting loss of climb performance caused by the extended flaps would result in the aircraft not being able to achieve the climb gradient requirements specified for a given departure runway. The increased drag caused by an un-feathered propeller would further reduce performance. According to the POM, the combination of the loss of engine power, the extended flaps and the un-feathered propeller would result in the aircraft not being able to maintain altitude.

The MU-2B aircraft is a high-performance twin turboprop aircraft. About 400 MU-2 aircraft are active worldwide, including 309 in the United States and 16 in Canada. A number of them have crashed following engine failures during takeoff or immediately after becoming airborne. In situations in which an engine fails at a critical stage of the takeoff, the crew must take rapid and positive action to reduce the drag on the aircraft in order to maintain a positive rate of climb. Unless appropriate action is taken, there is a risk of loss of aircraft and related fatalities, such as were observed in this accident.

Based on the circumstances of this occurrence, Transport Canada may wish to remind MU-2B and other twin-engine operators of the importance of ensuring the required checklist actions are carried out immediately after recognizing an engine has failed on takeoff. △

Computers in Aviation: Friend or Foe?

by Michael Oxner. Mr. Oxner is a terminal/enroute controller in Moncton, N.B., with 15 years of experience. He is a freelance aviation safety correspondent for www.aviation.ca.

In days gone by, aviation was about stick and rudder; pilot skills were paramount in handling an airplane. These days, things are getting more complicated. Aircraft systems are becoming increasingly automated; flight information, such as flight status and weather conditions, is more readily available; and aircraft navigation systems are changing, allowing more flexible routes of flight, and less dependence on the ability of a pilot to fly a particular course from a ground-based navigation aid (NAVAID).

Computers make all of this possible; they receive information via data link rather than requiring a pilot to communicate by voice with dispatchers; they display the status of aircraft systems and position in more logical ways; and they do complex calculations for aircraft navigation, including automated guidance along programmed courses.

With all these advances in computer technology entering the cockpit, it's no wonder that sometimes the computers get the best of us. Each of us has, at some point or another, been in the position of being "behind the curve" with a computer of some kind. Whether it comes down to programming the clock on the VCR, playing a game on a computer, or dealing with a high-tech piece of hardware, we've all discovered that computers do exactly what they're told to do—even if we make a mistake in telling them what we want them to do.

There are few areas, however, where simple mistakes, such as transposing a digit, can result in serious consequences. Aircraft navigation is one of those places where danger can lurk in unexpected places.

Sometimes it's an inadvertent error; sometimes it's getting carried away with the navigation equipment's capabilities; and other times it's a misunderstanding of the system and its effect. Here are a few examples of when things can go awry, and the reasons may be obvious, or they may be fairly subtle.

As a controller, I have witnessed a few of the subtleties of such errors. Once, a pilot had asked for direct BIMKU, the intermediate approach fix (IF) for an approach at an airport only 30 NM away. It should have amounted to a left turn of approximately 10°; however, the aircraft's track on radar appeared to change 110° to the left. When queried, the pilot told me he had inadvertently selected BIMTU from the database, a fix associated with another airport, about 100 NM north of his intended destination. If another aircraft had been on a parallel vector on his left side, this could have been very interesting, to say the least.

A similar error can be made when entering geographical coordinates. Accidentally entering 45°05'32" for latitude instead of 45°50'32" is a whopping error of 45 NM—all because two digits were transposed. Similarly, close placement of keys on a keypad can result in accidental

selection of a nearby key—perhaps entering 48° instead of 45° in the previous example, which would have been even worse. One method of crosschecking such an entry for error is to compare the geographical coordinate to the desired entry backwards, helping to take the complacency factor out of data entry. It may take a little time, but it may also be well worth the investment.

Other errors that can occur can also be derived from complacency. Trusting the navigation system to get you where you want to go can be a mistake. Quite frequently, pilots ask for routings through restricted airspaces simply because a direct routing, made possible by GPS and other systems, is much easier to enter into a system. Looking at charts and picking out points takes time, and the practice also tends to take an aircraft off an optimal direct routing. However, a look at the charts during the flight planning stage may reveal reasons why a direct route is simply not acceptable to pilots or controllers.

Sometimes, pilots may make unintentional entries into navigation systems. While perusing a database for approaches, a pilot may inadvertently activate an approach and make a turn that ATC does not expect. Even a slight turn may compromise separation with surrounding aircraft, especially in a terminal environment where controllers apply minimum separation to use airspace as efficiently as possible.

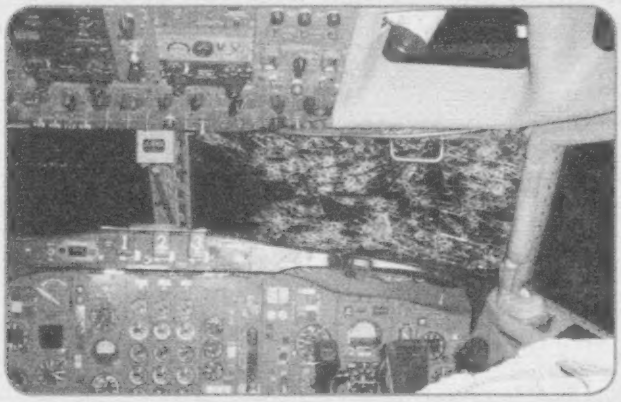
Also, restricted airspaces may come into play during the transition from the en-route phase of flight to the approach phase. Saint John, N.B., for example, is located very close to the Gagetown, N.B., restricted area (CYR724), an area of live firing. Many pilots of varying experience have asked for clearances allowing navigation directly to fixes associated with an approach, only to have ATC deny the clearance. The reason is that many pilots tend to rely on the navigation gear to take them where they want to go, but forget about the possibility of obstacles or restricted areas between where they are at the time and where the desired fix is. The approach plates may have too narrow a focus to show the proximity of the restricted airspace, leading a pilot to believe there is no reason not to fly to a particular fix.

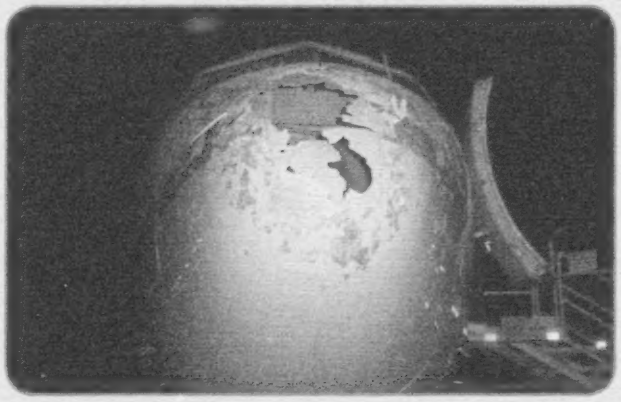
Another common error is when a pilot asks for clearance to an IF for an approach. If a turn of more than 90° is required for the aircraft to turn onto the final approach course, a pilot will sometimes program the autopilot to project a waypoint beside the IF, in effect making a base leg for the autopilot to fly. Some pilots doing this don't ask for approval for such a manoeuvre, and navigate to a point that ATC is not expecting, which may affect other traffic. Also, if the approach plate does not provide for such a manoeuvre, as an RNAV approach may, how does the pilot know what altitude is safe that far away from the final approach course?

Yes, computers can be our friends; they can offload a lot of work from a flight crew, especially those menial and repetitive calculations, but there are many pitfalls that can turn into big issues without proper care and attention. Familiarity with how a system operates, and what erroneous keystrokes may do, can literally save lives. Take care in the skies, and watch the computers carefully. They do what they're told to do, even if we don't realize what we're telling them to do. △

Hail Damage...

While in cruise at FL 300 after departing Calgary, Alta., this Boeing 727 sustained extensive hail damage after an encounter with a severe thunderstorm. In addition to the damage shown, wing leading edges, engine inlets and landing lights lenses were also damaged. The aircraft returned to Calgary for an uneventful landing and was later repaired.





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Ageing Airplane Rulemaking

by Blake Cheney, Acting Manager, Domestic Regulations, Regulatory Standards, Aircraft Certification, Civil Aviation, Transport Canada

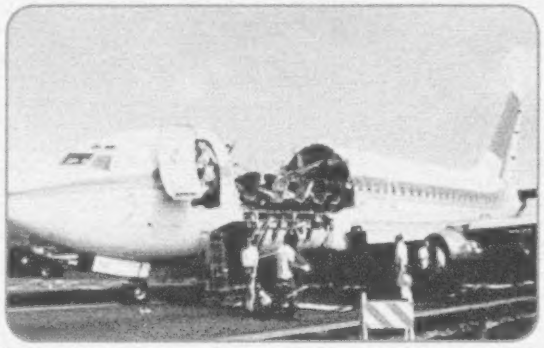
When many of us think of ageing airplanes, images come to mind of proudly displayed vintage warbirds and other enduring examples of aviation's first century of flight. However, perhaps less obvious is the world of transport and commuter category airplanes that each day transport passengers and cargo to diverse destinations around the globe. Yes, even the stylishly painted and freshly washed passenger jets transporting us for business, pleasure and to holiday destinations could be considered in the same breath as those vintage warbirds.

For those following the progress of the Federal Aviation Administration (FAA) rulemaking activities, collectively known as the Aging Airplane Program, launched following the Aloha Airlines Boeing 737-200 accident of 1988, the subject of ageing airplanes will be hardly new. In many respects, the term "ageing airplane" itself is getting long in the tooth. What is new is the approach now being taken to address design and maintenance issues associated with ageing structures, wiring and fuel tank safety.

Recent regulatory activity by the FAA, the European Aviation Safety Agency (EASA), the Brazilian *Agência Nacional de Aviação Civil* (ANAC) and Transport Canada Civil Aviation (TCCA), has brought to bear a focus on enhancing the safety of the current and expected future fleet of ageing airplanes. The current rulemaking initiatives recognize that many airplanes are still in service beyond their design life goal. The design life goal is a "life expectancy" in flight cycles or hours that is generally established early in the development of a new airplane and based on economic analysis, past experience with other models, and in some cases, fatigue testing. In addition, numerous accidents have raised awareness of safety issues associated with the design and maintenance of ageing airplane structures and systems.

New requirements will focus on re-evaluations of existing designs against new airworthiness standards, revising maintenance and inspection programs, and imposing flight operations requirements that would prohibit the operation of airplanes that do not incorporate required modifications and/or changes to their maintenance programs.

While the Aloha Airlines accident was not the first ageing airplane fatal accident, it was the one that brought the issue to public attention. The Boeing 737-200 was a high-cycle aircraft that suffered a partial in-flight disintegration in which an 18-ft crown section of the fuselage was torn apart in flight. The accident investigation revealed the presence of small cracks at multiple rivet locations in a disbonded lap joint, which were sufficient in size and density to cause the accident. This phenomenon is referred to as widespread fatigue damage (WFD).



April 28, 1988: Aloha Airlines flight 243, Boeing 737-200 near Maui, Hawaii, fuselage upper crown skin and structure separated in flight.

Historically, we may look back to 1977 for what could be argued as the first ageing-airplane related accident; a Dan-Air Services Boeing 707-321C that crashed on final approach in Lusaka, Zambia. The airplane, engaged in a non-scheduled international cargo flight, happened to be the first aircraft off the 707-300C series convertible passenger/freighter production line. On approach, the airplane pitched rapidly nose down, dived vertically into the ground from a height of about 800 ft, and caught fire. The accident was determined to be caused by a loss of pitch control following the in-flight separation of the right-hand horizontal stabilizer and elevator as a result of a combination of metal fatigue and inadequate fail-safe design in the rear spar structure. Shortcomings in design assessment, certification, and inspection procedures were contributory factors. A post-accident survey of the 707-300 fleet worldwide revealed a total of 38 aircraft with fatigue cracks present in the stabilizer rear spar top chord.

A Dan-Air Services Boeing 707-300C, similar to the aircraft that crashed near Lusaka, Zambia, on May 14, 1977.

Our own Canadian experience involved a Douglas DC-3C wing separation near Pickle Lake, Ont., in 1987. Two other pilots flying in the vicinity at the time described the final moments of the aircraft flight as having been in an inverted attitude descent with the left wing folded upwards. The Canadian Aviation Safety Board (CASB Report No. 87-C70022) determined that the left wing failed under normal flight loads as a result of a fatigue crack in the centre section of the lower wing skin. It was also found that anomalies in the radiographs previously taken during mandatory non-destructive testing inspections were not correctly interpreted. As a result, Transport Canada conducted the *Study of Non-Destructive Testing in Canadian Civil Aviation*, which was completed in January 1988. The study identified a number of shortcomings, and recommended that non-destructive testing (NDT) personnel certification standards (CGSB, MIL-STD-410, ATA 105) be recognized as airworthiness standards, and that NDT work be done under an approved maintenance organization (AMO). *Canadian Aviation Regulations* (CARs) 571 and 573 were amended to include these requirements. In 1996, TCCA published CAR 511.34—*Supplemental Structural Integrity Items* to require, for all principle structural elements, the development of any change or procedure necessary to preclude the loss of the airplane or a significant reduction in the overall structural strength of its airframe.

Subsequent to the 1988 accident, the FAA greatly expanded its structural integrity inspection program and formed the Airworthiness Assurance Working Group (AAWG) with five focus areas to examine structural issues related to widespread fatigue damage and corrosion (www.faa.gov/regulations_policies/rulemaking/committees/arac/issue_areas/tae/aa/):

- Service Bulletin Review
- Supplemental Inspections
- Maintenance Programs
- Corrosion Prevention and Control Programs
- Repair Assessment Programs.

Whereas the accidents to date were raising awareness to ageing structural issues, it was not yet realized that aircraft systems ageing-related failures could be just as catastrophic. That all changed on July 17, 1996, when Trans World Airlines (TWA) flight 800, a 25-year old Boeing model 747-131, was involved in an in-flight break-up after takeoff from John F. Kennedy International Airport in New York, resulting in 230 fatalities. The accident investigation conducted by the National Transportation Safety Board (NTSB/AAR-00/03) indicated that the centre wing fuel tank (CWT) exploded due to an unknown ignition source. However, of the ignition sources evaluated by the investigation, the most likely cause was a short circuit outside of the CWT that allowed excessive voltage to enter it through electrical wiring associated with the fuel quantity indication system.

July 17, 1996: Trans World Airlines flight 800, a Boeing 747-131, in-flight break-up over the Atlantic Ocean, near East Moriches, N.Y., 230 fatalities.

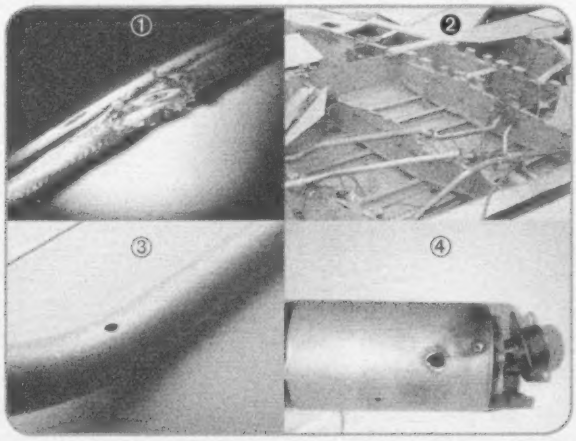
This accident prompted the NTSB, the FAA and industry to examine the underlying safety issues surrounding fuel tank explosions, the adequacy of the existing regulations, the service history of airplanes certificated to these regulations, and existing fuel tank system maintenance practices. The NTSB/FAA accident investigation included:

- Review of fuel tank system design features of Boeing 747 and certain other models; and
- Inspection of in-service and retired airplanes.

The TWA flight 800 accident investigation was still in progress when, on September 2, 1998, Swissair (SR) flight 111, a McDonnell Douglas MD-11, experienced an in-flight fire approximately 53 min after departure from New York, that would ultimately lead to the aircraft colliding with water near Peggy's Cove, N.S., and would result in 229 fatalities. The accident investigation, conducted by the Transportation Safety Board of Canada (TSB AIR Report No. A98H0003), identified the cockpit attic and forward cabin drop-ceiling areas as being the primary fire-damaged area, and that the most prevalent potential ignition source was electrical energy.

It should be noted that the SR flight 111 occurrence aircraft was manufactured in 1991, and therefore, should not be considered an aged airplane. In addition, a historical review conducted by the FAA of fuel tank explosions prior to the TWA flight 800 accident revealed that ageing was not the only contributing factor in the development of potential ignition sources. In particular, in May 1990, the centre wing tank of a Boeing 737-300 exploded during push back from a terminal gate prior

to flight, as the result of an unknown electrical ignition source; the aircraft was less than a year old. Hence, the development of such failures may be related to both the design and maintenance of the airplane systems.



Photos courtesy of FAA SFAR 88 Workshop, June 2001: Potential ignition sources discovered by fleet inspection. 1. Frayed fuel pump wire; 2. Main tank over pressure; 3. Arc through conduit; 4. Arc through pump housing.

In January 1999, the FAA chartered the Aging Transport Systems Rulemaking Advisory Committee (ATSRAC). Whereas the AAWG's focus had been on structural integrity and the effects of structural corrosion and fatigue, ATSRAC (www.mitrecaasd.org/atsrac/) was tasked to "propose such revisions to the *Federal Aviation Regulations* (FARS) and associated guidance material as may be appropriate to ensure that non-structural systems in transport airplanes are designed, maintained, and modified in a manner that ensures their continuing operational safety throughout the service life of the airplanes."

In parallel, the Aerospace Industries Association (AIA)/ Air Transport Association of America (ATA) conducted an aircraft fuel system safety investigation. The team inspected multiple in-service airplanes, and this industry program gathered significant information about the overall integrity of the design and maintenance of these aircraft. Well over 100 000 labour-hours were reportedly expended performing inspections of the world fleet. As of June 1, 2000, inspections had been completed on 990 airplanes, with a further 30 airplanes to be completed shortly thereafter, operated by 160 air carriers in diverse operating environments on six continents.

On April 21, 2001, after 18 months of deliberation, including 3 months of public consultation (including inputs from Transport Canada and other civil aviation authorities [CAA]), the FAA issued the Final Rule of *Special Federal Aviation Regulation* (SFAR) No. 88. This new rule promulgated improved design standards for transport category (large) airplanes, developed with the knowledge gained following the tragedy of TWA flight 800. SFAR No. 88 included a comprehensive requirement for manufacturers, owners and operators to conduct a one-time fleet-wide re-evaluation of all large airplanes of the jet age, with respect to their fuel system design and maintenance practices, against the revised and improved safety standards. TCCA, the Joint Aviation Authorities (JAA), and other CAAs supported this important safety initiative. Manufacturers conducted extensive design reviews, and their findings were reviewed by the airworthiness authorities to verify compliance with the new requirements and to mandate corrective actions where necessary (www.fire.tc.faa.gov/systems/fueltank/intro.stm).

Through their participation in the AAWG, ATSRAC and/or the FAA's Transport Airplane and Engines Issue Group (TAEIG), EASA, TCCA and ANAC (then called *Centro Técnico Aeroespacial* [CTA]) have monitored and/or participated in the development of proposals for the Aging Airplane Program rulemaking initiatives.

The Aging Airplane Program initiatives consist of multi-disciplinary regulatory activities including:

(1) *Transport Airplane Fuel Tank System Design Review, Flammability Reduction and Maintenance and Inspection Requirements; Final Rule* (issued April 19, 2001) and the *Fuel Tank Safety Compliance Extension; Final Rule* (issued July 21, 2004);
(2) *Enhanced Airworthiness Program for Airplane Systems / Fuel Tank Safety; Notice of Proposed Rulemaking* (NPRM) (issued September 22, 2005);
(3) *Aging Airplane Safety; Final Rule* (issued January 25, 2005);
(4) *Aging Aircraft Program: Widespread Fatigue Damage;* NPRM (issued April 11, 2006); and
(5) *Damage Tolerance Data for Repairs and Alterations;* NPRM (issued April 13, 2006)

Other related FAA regulatory initiatives include:

(6) *Repair Assessment of Pressurized Fuselages; Final Rule* (issued April 19, 2000); and
(7) The new approach for requirements for design approval holders (part of *Aging Airplane Program Update*, issued on July 21, 2004).

TCCA has recently initiated Canadian-specific rulemaking activities and has invoked a Canadian Aviation Regulation Advisory Council (CARAC) Working Group on Ageing Aeroplane Rulemaking and Harmonization Initiatives (AARHI), covering the structural and non-structural subjects. The Working Group is a joint undertaking of government and the aviation community, representing an overall aviation viewpoint. The Working Group will disposition into

the Canadian regulatory framework the findings of both AAWG and ATSRAC. At the same time, the Working Group will seek to maximize compatibility with other regulatory authorities. (For more information on CARAC, please see www.tc.gc.ca/civilaviation/regserv/affairs/carac/menu.htm)

EASA has also initiated regulatory activities that will strive to be harmonized with the FAA by creating the European Ageing Systems Coordination Group (EASCG). EASA has separately examined the ageing structures issues, but is anticipated to convene a Working Group this year to disposition those issues with input from the European industry.

Following presentation of the CARAC AARHI Working Group recommendations, TCCA will seek to publish new regulations and standards that will parallel those of the FAA's Aging Airplane Program. It is anticipated that the TCCA rulemaking will include new design approval holder (DAH) requirements, specifically for type certificate (TC) and supplemental type certificate (STC) holders, to supply data and documents in support of operator compliance with related flight operations rules. In some cases, repair design certificate (RDC) and limited STC (LSTC) holders may also be affected. The DAH requirements would reference technical standards, and include consideration for compliance planning applicable to existing DAHs and applicants for new and amended design approvals, to ensure that an acceptable level of safety is maintained for the affected airplanes.

TCCA, EASA, ANAC and the FAA have agreed to work together on the ageing airplane initiatives in an effort to foster a common understanding of the respective rulemaking activities, to provide for coordinated implementation, and to coordinate the eventual compliance findings between the appropriate CAAs, where possible using procedures developed under the bilateral agreements. △

Bilateral Agreements on Airworthiness—An Overview and Current Status

by Carlos Carreiro, International Regulations, Regulatory Standards, Aircraft Certification, Civil Aviation, Transport Canada

What is a bilateral agreement on airworthiness?

A bilateral agreement on airworthiness is an administrative arrangement that has the objective of promoting aviation safety by strengthening technical cooperation and mutual acceptance of tasks related to the airworthiness of aeronautical products.

For the purpose of this article, we will simply use the term "agreement" whenever we want to refer to a bilateral agreement on airworthiness.

Why do we enter into an agreement?

The Canadian *Aeronautics Act* has the purpose of providing for safe, efficient and environmentally-responsible aeronautical activities, by means that include ensuring that Canada can meet its international obligations relating to aeronautical activities.

Paragraph 4.2 (1)(j) of the *Aeronautics Act* prescribes that the Minister (to be considered the Minister of Transport for the purpose of this article) may enter into administrative arrangements with the aeronautics authorities of other governments or with organizations acting on behalf of other governments, in Canada or abroad, with respect to any matter relating to aeronautics.

Before entry into Canada, aeronautical products designed in a foreign state require approval to ensure Canadian airworthiness design standards are fully satisfied, regardless of whether the product received prior certification by a foreign airworthiness authority. Conversely, the certification of aeronautical products that are designed in Canada must be validated by foreign airworthiness authorities upon exportation from Canada. This review, at times, may be very lengthy and require a lot of resources from the civil aviation authority (CAA) from both the exporting and importing States.

In summary, the presence of an agreement on airworthiness or certification of aeronautical products is not only very cost-beneficial for Canadian organizations exporting aeronautical products to other foreign States, but it also promotes a significant exchange of technical cooperation among States.

Characteristics of an agreement

An agreement can be entered between:

- Canada and another government under a Treaty (legally binding); or
- The Minister of Transport or Transport Canada Civil Aviation (TCCA) and their counterpart office, as an administrative or technical cooperation arrangement (not legally binding). Examples of this kind of agreement are: Technical Arrangements and Memoranda of Understanding, among others.

An agreement can only relate to civil aviation safety issues (not commerce or trade issues), and it should be within the current scope and authority of the Canadian regulations.

Foreign Affairs Canada (FAC) has primary responsibility in legally-binding agreements. For other agreements, the Minister of Transport or TCCA can engage directly.

An agreement cannot relieve the Minister of Transport of their statutory responsibilities, which, under the *Aeronautics Act* and the *Canadian Aviation Regulations* (CARs), cannot be transferred.

Steps to an agreement

The following steps are required in order for Canada to enter into an agreement with another State or organization:

1) There must be a mutual desire to strengthen and formalize technical cooperation in promoting safety, which would increase efficiency in matters relating to safety, and reduce economic burden due to redundant airworthiness reviews (technical inspections, evaluations, testing).

2) Areas of cooperation must be defined:
   - Technical assistance to bilateral partner in their approval and certification activities;
   - Harmonization of standards and processes;
   - Facilitation of the exchange of civil aeronautical products and services;
   - Mutual recognition and reciprocal acceptance of approval and certificates;
   - Other areas, as mutually agreed.

3) Each State's legislation and regulatory system must be assessed and deemed to be equivalent. The civil aviation regulatory framework shown below, is used when assessing equivalency.

4) Competence and capability of a bilateral partner must be assessed as to their ability to achieve results similar to those obtained by TCCA.

5) Compliance with the Chicago Convention must be assessed.

6) Effectiveness of oversight and enforcement programs must be assessed.

7) Once confidence is established with steps 1 to 6, negotiations and a draft agreement may proceed.

The conclusion of an agreement is reached in the following manner:

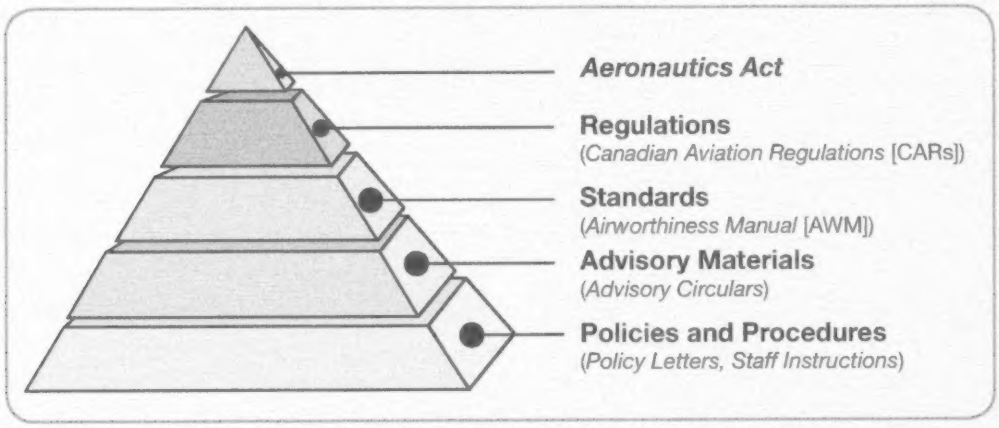
- For Treaties—Signatures by both governments (States).
- For non-Treaty (not legally binding)—Signatures by Minister of Transport of Canada and bilateral partner equivalent. (The signature of the Minister commits Transport Canada, and not the Canadian Government.)

In terms of the time required to conclude an agreement, it may take up to 3 years for a legally-binding agreement (due to the lengthy review process and legal nature), and 3 months to 2 years for an agreement that is not legally binding (depending on the complexity and scope of the agreement).

Status of agreements on airworthiness

Please refer to the following Web site for information on agreements on airworthiness that have been signed by TCCA or the Government of Canada (in the case of a legally-binding agreement):
www.tc.gc.ca/CivilAviation/certification/Int/menu.htm.

For further questions or clarifications, please contact the author at carreic@tc.gc.ca. △



The following summaries are extracted from Final Reports issued by the Transportation Safety Board of Canada (TSB). They have been de-identified and include the TSB's synopsis and selected findings. Some excerpts from the analysis section may be included, where needed, to better understand the findings. We encourage our readers to read the complete reports on the TSB Web site. For more information, contact the TSB or visit their Web site at www.tsb.gc.ca. *—Ed.*

TSB Final Report A04Q0003—Loss of Separation

On January 13, 2004, a Boeing 777, en route from John F. Kennedy Airport, N.Y., to Narita, Japan, was at flight level (FL) 350 on a converging track with a Boeing 767, at FL 350 en route from Paris, France, to Chicago, Ill. Both aircraft received a traffic alert and collision avoidance system (TCAS) resolution advisory (RA), to which they responded. The two aircraft passed each other at 13:22 Eastern Standard Time (EST), within 600 ft laterally and 1 100 ft vertically of one another, approximately 160 NM south of La Grande Rivière, Que., in radar-controlled airspace. The air traffic controllers had not detected the conflict until alerted by the ATC conflict alert program. The required separation was 5 NM laterally or 2 000 ft vertically.

Findings as to causes and contributing factors

1. The potential conflict between the B767 and the B777 was not detected when the B767 first contacted the La Grande Rivière (CYGL) sector, and no action was taken by the first CYGL controller to remind the next controller that a conflict probe had not been completed. This allowed a potential conflict to progress to the point of a risk of collision.

2. After accepting the handover of the CYGL sector, neither the trainee nor the on-the-job instructor (OJI) conducted a review of all aircraft under their control to ensure there were no potential conflicts; the conflict between the B767 and the B777 was not detected, which placed them in a potential risk of collision situation.

3. After the ATC conflict alert program warned the trainee and the OJI of the impending loss of separation, the OJI was unable to communicate instructions to the involved aircraft because he used the foot pedal instead of the press-to-talk switch to activate the radios. As a result, the aircraft progressed to the point where only the TCAS RA prevented a potential collision.

Findings as to risk

1. There is no medium-term conflict probe for radar-controlled airspace to provide an additional backup to the controllers scanning the radar or relying on information on the flight data strips.

2. The current operational conflict alert system provides minimal warning time for the controller and requires immediate and often drastic action by both the controller and the aircrew to avoid a mid-air collision.

3. Because the TCAS is not mandatory in Canada, there continues to be an unnecessary risk of mid-air collisions within Canadian airspace.

Other findings

1. The lack of realistic and recurrent simulation training may have delayed the OJI's quick and efficient recovery from a loss of separation situation, or may have contributed to his inappropriate response to the conflict alert warning.

2. The OJI's training course focussed mainly on the interpersonal aspects of monitoring a trainee. It did not cover practical aspects, such as how to effectively share work knowledge and practices with a trainee or how to quickly take over a control position from a trainee when required.

Safety action taken

The Montréal area control centre (ACC) published an operations bulletin containing information to ensure that all controllers involved in on-the-job training know how to operate their communications equipment and gain immediate access to their frequencies. This operations bulletin was a mandatory verbal briefing item for all controllers.

TSB Final Report A04Q0041—Control Difficulty

On March 31, 2004, a DHC-8-300 was proceeding from Montréal, Que., to Québec, Que., with three crew members and three passengers on board. After takeoff, at about 3 000 ft above sea level (ASL), the aircraft banked left and force had to be applied on the steering wheel to keep the wings level. The checklist for a runaway aileron trim tab was completed, which corrected the situation; however, the flight crew found that the trim tab indication, which was fully to the right, was not normal.

Emergency services were requested and the aircraft continued on its flight to Québec. On final approach for Runway 24 at Québec, the crew was advised by the controller that the airline required it to not continue with the approach. A missed approach was executed and it was suggested to the captain that he come back for a no-flaps landing. The aircraft came back and landed with no flaps without incident at 10:52 EST.

Findings as to causes and contributing factors

1. The aileron trim tab was improperly aligned, which contributed to the tendency of the aircraft to roll on departure from Montréal.

2. The absence of a placard near the indicator, and the arrangement of information in the logbook, contributed to the crew being unaware of the defective aileron trim tab indicator.

Findings as to risk

1. Poor task distribution between the assistant chief dispatcher and the flight dispatcher created confusion in the telephone conversations with the tower controller, which delayed transmission of the second order to execute a missed approach, resulting in a missed approach at very low altitude.

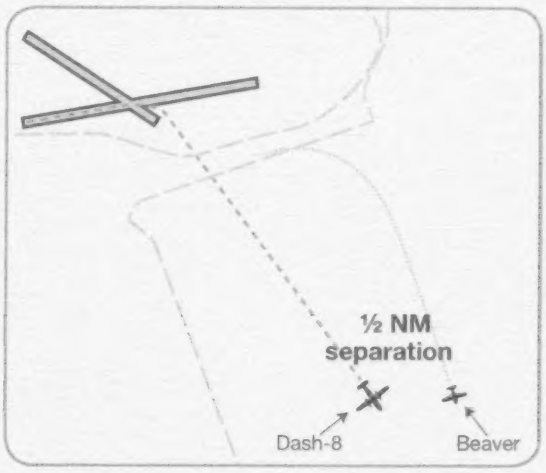
2. The trim tab had been improperly adjusted during prior service; an incorrect indication of the position of the aileron trim tab in the cockpit might have resulted if the indicator had been serviceable.

Safety action taken

As part of its safety management system (SMS), the operator initiated an internal investigation to draw lessons from this occurrence in order to use them for crew resource management (CRM) training.

TSB Final Report A04P0153—Air Proximity—Safety Not Assured

On May 5, 2004, a float-equipped de Havilland DHC-2, Mk 1 Beaver was authorized by the Vancouver tower south (TS) controller for an eastbound takeoff, on a VFR flight plan, from the Fraser River just south of the Vancouver International Airport, B.C., with a right turn to the Vancouver (YVR) VHF omnidirectional range (VOR) at 1 000 ft. A de Havilland DHC-8-100 (Dash-8) was subsequently cleared for takeoff from the Vancouver International Airport on an IFR flight plan to Nanaimo, B.C., using Runway 08R, with a Richmond 8 standard instrument departure (SID). The Richmond 8 SID calls for a right turn at 500 ft and a climb on heading 141° magnetic (M) to 2 000 ft. The Dash-8 climbed to 500 ft and initiated a right turn well before the end of the runway. The crew reported through 1 000 ft, heading 140°M, and substantially reduced their rate of climb, which brought them into close vertical proximity with the Beaver. Subsequently, the pilot took evasive action when he observed the Beaver below on the left side. The Vancouver departure south (DS) controller noticed the conflict and advised the Dash-8 crew of "unverified" traffic on their left side at 1 100 ft. He instructed the Dash-8 crew to turn at their discretion to avoid the traffic. The Dash-8 crew turned right and climbed on a heading of 190°M to resolve the conflict. The occurrence took place at 08:18:47 Pacific Daylight Time (PDT).



Findings as to causes and contributing factors

1. The TS controller cleared the Dash-8 for takeoff from the Runway 08R threshold without considering the change to the aircraft's departure profile from the usual intersection departure. As a result, an air proximity occurred between the Dash-8 and the Beaver.

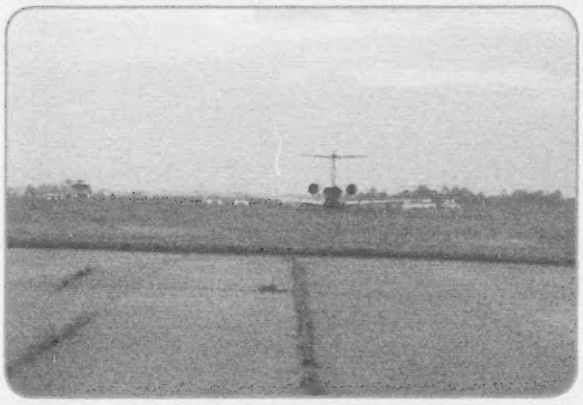
2. The coordination among the TS, traffic advisory (TA), and DS controllers that is necessary to fulfill the requirement for traffic information and conflict resolution did not take place. As a result, the two departing aircraft did not receive the ATC services specified for the class of airspace within which they were flying.

3. The TA controller's attention was diverted to other traffic under his responsibility, and he did not see the Dash-8 coming up behind the Beaver. As a result, the two aircraft came into close proximity before the Dash-8 crew saw the other aircraft and took evasive action.

4. Because the Dash-8 crew expected a clearance to remain at 2 000 ft, they substantially decreased their rate of climb, creating the conflict with the Beaver and extending its duration.

TSB Final Report A04O0188—Runway Overrun

On July 14, 2004, an Embraer 145LR aircraft departed Pittsburgh, Pa., on a flight to Ottawa/Macdonald Cartier International Airport, Ont., with two flight crew, one flight attendant, and 28 passengers on board. At 17:20 Eastern Daylight Time (EDT), the aircraft landed on Runway 25 at Ottawa and overran the runway, coming to rest approximately 300 ft off the end of the runway in a grass field. There were no injuries. The aircraft sustained minor damage to the inboard left main landing gear tire. When the aircraft landed, there were light rain showers. After the rain subsided, the passengers were deplaned and bussed to the terminal.



Findings as to causes and contributing factors

1. The approach to Runway 25 was high, fast, and not stabilized, resulting in the aircraft touching down almost halfway down the 8 000-ft runway.

2. The aircraft landing was smooth; this most likely contributed to the aircraft hydroplaning on touchdown.

3. The anti-skid system most likely prevented the brake pressures from rising to normal values until 16 to 19 seconds after weight on wheels, resulting in little or no braking action immediately after landing.

4. The flight crew were slow to recognize and react to the lack of normal deceleration. This delayed the transfer of control to the captain and may have contributed to the runway overrun.

Other findings

1. It could not be determined if an electrical, mechanical, or hydraulic brake problem existed at the time of the landing.

2. The flight crew did not take appropriate measures to preserve evidence related to the occurrence and, therefore, failed to meet the requirements of the U.S. *Federal Aviation Regulations* (FARs), the *Canadian Aviation Regulations* (CARs), and the *Canadian Transportation Accident Investigation and Safety Board Act* (CTAISB Act). Interference with the cockpit voice recorder (CVR) obstructs TSB investigations and may prevent the Board from reporting publicly on causes and safety deficiencies.

TSB Final Report A04W0200—Navigation Deviation

On September 10, 2004, a Beech King Air C90A was en route to the Edmonton City Centre Airport (Blatchford Field), Alta., from Winnipeg, Man., via Regina, Sask., under IFR. After descending into the Edmonton terminal control area (TCA) in instrument meteorological conditions (IMC), the aircraft was vectored for a straight-in LOC(BC)/DME RWY 16 approach. Shortly after intercepting the localizer (LOC) near the LEFAT intermediate approach fix (IF), the aircraft descended about 400 ft below the minimum step-down altitude, and deviated 69° to the left of the final approach course. The crew conducted a missed approach 8 NM from the airport. During the missed approach, the airspeed decreased from 130 to 90 knots indicated airspeed (KIAS), and the aircraft climbed above three successive altitudes assigned by ATC. The aircraft also deviated 43° from its assigned heading while being vectored to rejoin the localizer for Runway 16. Upon intercepting the localizer for the second time, the aircraft turned to the right of the approach centreline and descended below the minimum step-down altitude. After the aircraft descended below the cloud base, the crew gained sight of the airport, continued the approach visually, and landed at 16:17 Mountain Daylight Time (MDT).

Findings as to causes and contributing factors

1. Because the flight crew did not have sufficient familiarity with the C90A electronic flight instrument system (EFIS) equipment's presentations and operation, they used improper electronic horizontal situation indicator (EHSI) course settings and flight director mode selection on three successive instrument approaches.

2. The inability of the crew to perform at the expected standard resulted from limited recent flying time and inadequate transition training in using the new avionics.

3. While flying a missed approach procedure, the pilot flying (PF) was unable to transition to effective manual control of the aircraft. As a result, the aircraft speed decreased significantly below a safe level, and the ATC-assigned altitudes and headings were not adhered to.

4. On the second approach at Edmonton, the crew focused on the GPS distance reading from the final approach fix (FAF), instead of the distance-measuring equipment (DME) display. This led to a premature descent, and the aircraft was operated below the minimum published step-down altitudes for the approach.

5. The crew's resource management in preparation for and during the three approaches was not sufficient to prevent the hazardous deviations from the required flight paths.

Finding as to risk

1. The operator did not encourage pilots to use manual flying skills in operational flying, thus creating the potential for manual flying skills degradation from non-use.

Other finding

A post-incident audit revealed a number of examples of non-compliance with the operator's *Flight Operations Manual*, including a lack of appropriate pilot-training record keeping. Therefore, there was no assurance that pilots would receive required training within specified time frames.

Safety action taken

The operator has corrected operational and training deficiencies that were revealed in a post-incident operations audit of the Edmonton base. Pilots who had not received the minimum flight training schedule mandated in the *Fixed Wing Operations Manual* were required to complete this training before their next operational flights. In addition, operational control of all flights was improved through a revised dispatch and flight-following system.

An internal safety bulletin distributed to the operator's pilots addressed the following issues associated with this occurrence:

- errors in managing automatic flight systems;
- encouraging periodic autopilot disconnect to improve monitoring vigilance;
- flight director/autopilot management;
- flight path deviations induced by autopilot activation; and
- timely pilot intervention to correct flight path deviations.

TSB Final Report A04Q0188—Runway Excursion on Landing

On December 1, 2004, a Beech B300 was on an IFR flight from Saint-Hubert, Que., to Saint-Georges, Que., with two pilots and one passenger on board. At 11:26 EST, following a Runway 06 RNAV (GPS) instrument approach, the aircraft was too high to be landed safely, and the crew carried out a missed approach. The crew members advised the Montréal Centre that they would attempt a Runway 24 RNAV (GPS) instrument approach. At 11:46 EST, the aircraft touched down over 2 400 ft past the Runway 24 threshold. As soon as it touched down, the aircraft started to turn left on the snow-covered runway. Full right rudder was used in an attempt to regain directional control. However, the aircraft continued to turn left, departed the runway, and came to rest in a ditch about 50 ft south of the runway. The aircraft sustained substantial damage. There were no injuries.

Findings as to causes and contributing factors

1. Because the aircraft's trajectory was not stabilized on the final phase of the approach, the aircraft was drifting to the left when the wheels touched down. The pilot-in-command was unable to keep the aircraft in the centre of the snow-covered runway, which had been cleared of snow to only 36 ft of its width.

2. The left main landing gear, then the nose wheel, struck a snow bank left on the runway by the snow-removal vehicle, and the pilot-in-command was unable to regain control of the aircraft.

Findings as to risk

1. The operator's pilots and ground personnel demonstrated inadequate knowledge of the SMS program by not recognizing the risk elements previously identified by the company.

2. Neither the pilot-in-command nor the co-pilot had received CRM training, which could explain their non-compliance with procedures and regulations.

3. Knowing that a snow-removal vehicle might be on the runway, the crew attempted to land on Runway 06

and, after the missed approach, the aircraft did not follow the published missed approach path.

4. On the Runway 24 approach, the crew descended below the minimum descent altitude (MDA) without having acquired the required references.

5. The aircraft's altimeters were not set on the altimeter setting for Saint-Georges.

Other finding

1. The proposed approach ban would not have prevented the crew from initiating the approach because the proposed ban does not apply to private companies, and the Saint-Georges aerodrome does not meet the meteorological observation requirements.

Safety action taken

Following this accident, the operator modified its company organization chart. The position of assistant director of operations was created to provide leadership at the company's main base when the director of operations is absent. Also, the company appointed a chief pilot for the Lear 60, responsible for the Montréal base, and check pilots were appointed for the Lear 45, the Lear 35, and the Beech B300.

The operator established new criteria for runway acceptability. No approaches will be allowed until the runway is fully cleared of snow and is clear of traffic. A runway report for Saint-Georges aerodrome will be provided to the flight service station (FSS) and sent to the pilot where possible.

The operator established visual references to enable the universal communications (UNICOM) personnel to estimate as accurately as possible the visibility and cloud ceiling at the Saint-Georges aerodrome. Furthermore, to avoid any confusion as to the snow-removal need, a call sequence was established to reach snow-removal employees. Also, the radio equipment in the snow-removal vehicles at Saint-Georges was modified to allow communication with the base and aircraft at all times.

The operator will provide an annual winter operations awareness program for its pilots and ground personnel.

The Canadian Business Aviation Association (CBAA) modified its symposium education program to promote a better understanding of the factors that lead pilots (and others) to not follow established procedures.

TSB Final Report A05Q0024—Landing Beside the Runway

On February 21, 2005, an HS 125-600A aircraft, with two crew members and four passengers on board, took off from Montréal, Que., at 17:56 EST, for a night IFR flight to Bromont, Que. Upon approaching Bromont, the co-pilot activated the lighting system and contacted the approach UNICOM (private advisory service). The flight crew was advised that the runway edge lights were out of order. However, the approach lights and the visual approach slope indicator (VASI) did turn on. The flight crew executed the approach and the aircraft touched down at 18:25 EST, 300 ft to the left of Runway 05L and 1 800 ft beyond the threshold. It continued on its course for a distance of approximately 1 800 ft before coming to a stop in a ditch. The crew tried to stop the engines, but the left engine did not stop. The co-pilot entered the cabin to direct the evacuation. One of the passengers tried to open the emergency exit door, but was unsuccessful. All of the aircraft's occupants exited through the main entrance door. Both pilots and one passenger sustained serious injuries, and the three remaining passengers received minor injuries. The aircraft sustained major damage.

Findings as to causes and contributing factors

1. The flight crew attempted a night landing in the absence of runway edge lights. The aircraft touched down 300 ft to the left of Runway 05L and 1 800 ft beyond the threshold.

2. The runway was not closed for night use despite the absence of runway edge lights. Nothing required it to be closed.

3. Poor flight planning, non-compliance with regulations and standard operating procedures (SOP), and lack of communication between the two pilots reveal a lack of airmanship on the part of the crew, which contributed to the accident.

Findings as to risk

1. Because they had not been given a safety briefing, the passengers were not familiar with the use of the main door or the emergency exit, which could have delayed the evacuation, with serious consequences.

2. The armrest of the side seat had not been removed as required and was blocking access to the emergency exit, which could have delayed the evacuation, with serious consequences.

3. Because they had not been given a safety briefing, the passengers seated in the side seats did not know that they were required to wear shoulder straps and did not wear them; so they were not properly protected.

4. The possibility of flying to an airport that does not meet the standards for night use gives pilots the opportunity to attempt to land there, which in itself increases the risk of an accident.

5. The landing performance diagrams and the chart used to determine the landing distance did not enable the flight crew to ensure that the runway was long enough for a safe landing on a snow-covered surface.

Safety action taken

On July 19, 2005, the TSB sent an aviation safety advisory to Transport Canada. The safety advisory states that, in this occurrence, the precautions embodied in the various civil aviation regulations did not prevent this night landing when the runway edge lights were unserviceable. Consequently, Transport Canada might wish to review the regulations with the goal of giving airport operators guidelines on how to evaluate the impact of a reduced level of service on airport use.

Pursuant to this safety advisory, Transport Canada determined that it would be very difficult to prepare guidelines that would cover all factors that are directly or indirectly associated with airport certification or operations. Moreover, Transport Canada believes that requiring aerodrome operators to evaluate the impact of a reduced level of service on aerodrome use would be a particularly complex task that could greatly increase the possibility of errors in assessment or interpretation. However, Transport Canada is examining the possibility of adding information on the level of runway certification to the *Canada Flight Supplement* (CFS), which would provide more information and details to pilots regarding any change to the certification status of a given runway. △

ACCIDENT SYNOPSES

Note: All aviation accidents are investigated by the Transportation Safety Board of Canada (TSB). Each occurrence is assigned a level, from 1 to 5, which indicates the depth of investigation. Class 5 investigations consist of data collection pertaining to occurrences that do not meet the criteria of classes 1 through 4, and will be recorded for possible safety analysis, statistical reporting, or archival purposes. The narratives below, which occurred between August 1 and October 31, 2006, are all "Class 5," and are unlikely to be followed by a TSB Final Report.

—On August 5, 2006, a Bell B206-B3 helicopter had landed on a log pad in the muskeg and, after a settling check, the throttle was turned down to idle. After about 30 seconds, the aft fuselage dropped, and the pilot placed the cyclic in the forward position. Mast bumping was felt, and the engine was shut down immediately. The tail rotor did not contact the ground, but there was considerable damage to the dynamic components. There were no injuries. *TSB File A06W0136.*

—On August 5, 2006, a PA-25-235 Piper Pawnee was spreading chemicals when the aircraft severed an electrical wire. The pilot headed toward the Rougemont, Que., airport, and landed normally. The pilot was not injured. The aircraft's propeller and right wing were damaged. *TSB File A06Q0134.*

—On August 7, 2006, an amateur-built basic ultralight Hipps J-3 Kitten was manoeuvring in the vicinity of St. Andrews, Man. The pilot had difficulty controlling the pitch attitude, and forced-landed in a field. After touchdown, the aircraft nosed over on its back. The pilot/owner/builder was not injured. Examination by the pilot after the incident indicated that part of the elevator control mechanism had failed in flight. *TSB File A06C0128.*

—On August 11, 2006, the pilot of the Grumman AA1 Tiger was ferrying his newly-purchased aircraft to Bellingham, Wash., when he encountered mountain weather, and the aircraft descended rapidly and crashed into trees. The pilot had been flying at about 6 500 ft ASL, was clear of clouds, and was about 1 mi. away from a ridge. He escaped with minor injuries, but the aircraft was destroyed. He broadcast Mayday calls and a search and rescue (SAR) Cormorant helicopter picked him up from the hillside about 3 hr after the crash. He was taken to hospital for evaluation. *TSB File A06P0159.*

—On August 20, 2006, a Bell 206L-3 helicopter was conducting oil field operations 40 NM northeast of Lac La Biche, Alta. During departure from an oil well site, the engine (Allison 250-C30P) lost power. The pilot entered autorotation, and the helicopter struck the ground at a high rate of descent. The main rotor severed the tail boom at impact and the pilot sustained serious injuries. The wreckage is being recovered to the TSB Pacific Region compound, and the engine will be examined at a local engine overhaul facility. *TSB File A06W0143.*

—On August 21, 2006, an Aerospatiale AS350 BA helicopter was departing from a drill site with a 60-ft

longline, on a local flight. On departure, the longline hook snagged a tree, and then broke free, flew up and fouled the tail rotor and tail boom. The helicopter lost tail rotor authority and rotated several times before the pilot made a forced landing in a wooded area. The pilot suffered minor injuries. The helicopter sustained substantial damage. *TSB File A06C0139.*

—On August 21, 2006, a rented Champion 7ECA Citabria was taxiing from the ramp to the runway at Steinbach South, Man. Before the aircraft reached the runway, it was observed making a wide turn, and then departing the taxiway and striking a Cessna Ag Truck, which was parked in the grass beside the taxiway. The Citabria sustained substantial damage; the Ag Truck sustained minor damage. *TSB File A06C0140.*

—On August 23, 2006, a DHC-2 Beaver on floats took off from Lac Louise, Que., for a VFR flight to Labrador City, Nfld. Shortly after takeoff, with crosswinds of approximately 15 kt, the pilot turned to the left. The aircraft ended up with a tail wind, and the rate of climb did not allow it to clear the obstacles. The aircraft struck some trees before crashing. The aircraft did not catch fire, but it did sustain substantial damage. The three occupants on board received minor injuries. *TSB File A06Q0147.*

—On August 24, 2006, a Cessna 180 on floats collided with the embankment of a privately-owned, man-made water runway during takeoff at the Tofino, B.C., airport. The aircraft was departing westbound (Runway 28) from the 1 400 x 80 ft-wide water runway. The wind was from 210°M at 5 kt. The water rudders were retracted for the take-off run. The pilot lost directional control as the aircraft was getting on the step and collided with the embankment on the left side. There were no injuries. There was substantial damage to the aircraft. *TSB File A06P0154.*

—On August 26, 2006, a Bell 206B helicopter descended into a tree during a longline operation, while manoeuvring to pick up a load. Both main rotor blades sustained substantial damage and had to be replaced prior to a maintenance ferry flight. There were no injuries. A shorter-than-normal longline was in use, the tree was in the seven o'clock position relative to the pilot, and the pilot had been instructed to move left of his intended position by the ground crew. *TSB File A06W0152.*

—On August 27, 2006, a float-equipped Cessna 175A crashed approximately 10 NM south of Lac Beauregard, Que. The pilot, alone on board, died. A weak emergency locator transmitter (ELT) signal had been heard at approximately 10:32; however, the weather conditions made it impossible to reach the accident site, and the aircraft was found the following day. The information gathered indicates that before departure, the pilot was unable to check the weather, which was forecast to be IFR conditions on his route. However, upon takeoff, despite storms to the west, the conditions on his route to the south were VFR. The angle at which the aircraft entered the forest at the accident site, indicates that at the time of impact, the aircraft was out of control. The evidence supports the hypothesis that the pilot had encountered weather conditions for which he was not prepared. There was no evidence of a mechanical failure. *TSB File A06Q0148.*

—On August 28, 2006, a Jabiru Calypso 3300 advanced ultralight crashed one hour after takeoff from the Maniwaki, Que., airport. The pilot, alone on board, was conducting a local VFR flight. The aircraft struck and severed the upper wire of a residential hydro line. The aircraft crashed in a corn field approximately 400 ft away. The pilot sustained fatal injuries. The aircraft wreckage was transported to the TSB laboratory in Ottawa, Ont., for examination. *TSB File A06Q0149.*

—On September 2, 2006, a Bell 206L-1 helicopter was picking up a group of kayakers at the confluence of the Tulsequah and Taku rivers, about 60 NM south of Atlin, B.C. A sling load of about 700 lbs of gear on the river bank was attached to the longline before a decision was made to return the passengers to the Tulsequah Chief exploration mine camp before flying their gear out. The helicopter took off with four of the passengers, but crashed into the river when it came to the end of the longline, which had remained attached to the aircraft. Two passengers received minor injuries and the helicopter was destroyed. *TSB File A06P0180.*

—On September 9, 2006, a Cessna U206G had departed Copper Point, Y.T. (north of Mayo), for a hunting camp. While en route through mountainous terrain, the pilot realized that the aircraft could not outclimb the rising terrain of the canyon floor. As the passage was too narrow to permit a 180° turn, the pilot force-landed into the trees. The pilot suffered minor injuries, the passenger suffered serious injuries, and the aircraft was substantially damaged. A helicopter evacuated the pilot and passenger after the rescue coordination centre (RCC) tracked the emergency locator transmitter (ELT) signal. *TSB File A06W0166.*

—On September 12, 2006, a PA28-180 was on the base leg for Runway 06R at St-Hubert, Que., returning from a recreational flight, when the engine (Lycoming O360-3A3) stopped. The aircraft struck some cables and cars before coming to a stop inverted on a street in an industrial neighbourhood. The two occupants, as well as four people on the ground, received minor injuries. The aircraft was substantially damaged, but did not catch fire. The emergency locator transmitter (ELT) went off upon impact. Four cars were also damaged. *TSB File A06Q0160.*

—On September 12, 2006, a PA-44-180, with an instructor and student on board, was doing circuits at the Cornwall, Ont., regional airport in preparation for a multi-engine flight test. While on a touch-and-go, just prior to lift-off, the landing gear handle was mistakenly selected to the up position. The nose gear retracted and both propellers contacted the ground. The aircraft became airborne, completed a circuit, and landed normally with the gear down. Both propellers were damaged beyond repair and the engines were sent for overhaul. *TSB File A06O0243.*

—On September 19, 2006, a float-equipped Piper PA-18-150 was departing from a private grass strip. The pilot was using a dolly towed behind a pick-up truck to takeoff. At lift-off, a float snagged the dolly. The aircraft veered and crashed in the field at the side of the strip. There were no injuries and the aircraft was substantially damaged. *TSB File A06C0149.*

—On September 29, 2006, an amateur-built Searey amphibian aircraft took off from Victoria International Airport, B.C., for a local flight, which was to include several water landings. The pilot did not retract the landing gear after takeoff. While flying over Saltspring Island, the pilot decided to make a practice water landing on St. Mary Lake. On touch down on the water, the nose dug in and the aircraft flipped over. The pilot was able to egress the aircraft and was picked up by a Beaver aircraft. The pilot sustained minor injuries. The aircraft was substantially damaged. *TSB File A06P0202.*

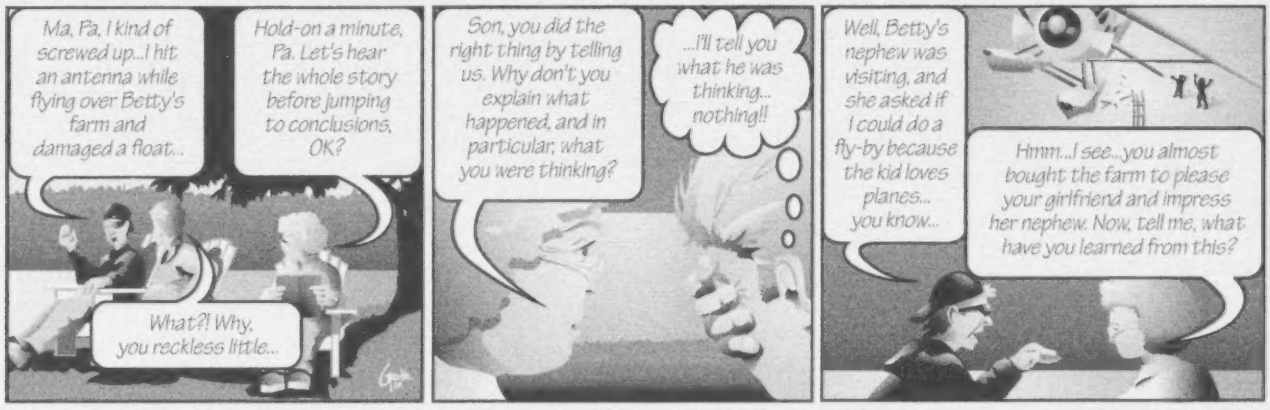
—On September 29, 2006, a Bell 206B helicopter was repositioning in front of a temporary hangar in Mayo, Y.T, when the tail rotor struck the structure. The tail rotor blades, tail rotor gearbox and tail rotor drive shaft required replacement. There were no injuries to the pilot or ground personnel. *TSB File A06W0178.*

—On October 5, 2006, while taxiing for takeoff at Toronto/Buttonville, Ont., a Piper PA-28-161 Cherokee struck a Cessna 150M; both were being operated by solo student pilots. The collision occurred at the intersection of Taxiways Charlie and Alpha. The 150 had been cleared southeastbound on Taxiway Charlie to turn right onto Taxiway Alpha to the holding bay for Runway 03. The Cherokee was southwestbound on Taxiway Alpha and had been held northeast of Runway 33. The Cherokee was cleared to cross Runway 33 on Taxiway Alpha, and follow the 150 southbound on Taxiway Charlie to the holding bay for Runway 03. The Cherokee missed the reference to the 150 in the clearance, and acknowledged without readback. It proceeded across Runway 33 paying attention to an aircraft on the left at the south end of Runway 33. At the intersection of the taxiways, the Cherokee overtook the 150 from approximately the 8 o'clock position while the 150 was in the turn. The propeller of the Cherokee caused substantial damage to the outer portion of the left wing of the 150, and the right wing tip of the Cherokee rode up over the left horizontal stabilizer of the 150, and over the aft fuselage of the 150, just in front of the vertical stabilizer. TSB investigators were deployed the following day to review ATC communications, examine the aircraft, and gather relevant information. *TSB File A06O0257.*

—On October 9, 2006, an Aerospatiale AS 350B helicopter was landing at a remote, confined and unprepared site. Prior to touchdown, the tail rotor struck a rise of ground near the centre of the site. The helicopter began to rotate around the vertical axis, directional control could not be regained, and the skids and tail boom broke away from the fuselage during the ensuing hard landing. The pilot and one passenger sustained injuries while the second passenger was uninjured. *TSB File A06W0186.*

—On October 15, 2006, a Lake LA-4-200 aircraft was on a flight from Winnipeg, Man., to St. Andrews, Man., with a planned stop at Selkirk, Man. While landing in glassy-water conditions, the aircraft landed hard and swerved. The aircraft came to rest upright on the surface of the water. The pilot was not injured. The aircraft incurred damage to the left sponson and the wing outboard of the sponson. *TSB File A06C0170.* △

BLACKFLY AIR


Ma, Pa, I kind of screwed up...I hit an antenna while flying over Betty's farm and damaged a float...
Hold-on a minute, Pa. Let's hear the whole story before jumping to conclusions, OK?
What?! Why, you reckless little...
Son, you did the right thing by telling us. Why don't you explain what happened, and in particular, what you were thinking?
...I'll tell you what he was thinking... nothing!!
Well, Betty's nephew was visiting, and she asked if I could do a fly-by because the kid loves planes... you know...
Hmm...I see...you almost bought the farm to please your girlfriend and impress her nephew. Now, tell me, what have you learned from this?

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Exploring the Parameters of Negligence: Two Recent TATC Decisions

by Beverlie Caminsky, Chief, Advisory and Appeals (Transportation Appeal Tribunal of Canada—TATC), Regulatory Services, Civil Aviation, Transport Canada

In this issue, the Advisory and Appeals Division of Regulatory Services again wishes to share with our readers some interesting developments in Canadian aviation case law. Two recent cases released by the Transportation Appeal Tribunal of Canada (TATC) deal with the issue of negligent conduct on the part of pilots. In one of the cases, the TATC Review Hearing findings are being appealed by the pilot. In the other, the pilot chose not to appeal. As is our practice, the names of the people involved have been deleted, as our goal remains simply to be educational.

Case #1

In the first case, the Applicant was the pilot-in-command of a small private aircraft approaching a rural airport. Two other aircraft were conducting circuits around the airport. The pilot joined the circuit, and it was agreed by all three aircraft that in the order of landing, the Applicant would be last. However, after joining the circuit, the Applicant made a sudden hard right turn on right base for the runway, ahead of the other planes. This action caused the other two aircraft to take evasive action. The Applicant was charged with flying in a "reckless or negligent manner" contrary to *Canadian Aviation Regulation* (CAR) 602.01.

At the Review Hearing, the Member upheld the Minister's decision. She found that the Applicant's actions were negligent and they endangered life and property. Both elements have to be established to uphold a violation of CAR 602.01. She also found that the defence of necessity was not established. However, the fine was reduced, given the fact that one of the other two planes was flying circuits in the wrong direction, which partially contributed to the situation.

The evidence established that the Applicant's sudden turn out of the circuit created a hazard. As there was no intention to create a conflict, the actions did not constitute recklessness, only negligence. The fact that all the pilots felt compelled to take evasive action proved that the situation endangered life and property.

The defence of necessity was raised by the Applicant, who argued that he initiated the turn because he was low on fuel and had to make an immediate landing. Existing jurisprudence identifies three elements that must be established by those seeking to plead necessity. First, a situation of imminent peril existed. Second, no reasonable legal alternative to the actions taken existed. Third, the danger caused by the contravention must have been less than the danger caused by complying with the law. Additionally, the defence is not available to those who, through their own actions, create the danger complained of.

The Member found that the Applicant's actions belied the imminence of the danger, as the pilot flew for several minutes after the evasive action before landing. Consequently, the defence failed.

Case #2

The second case concerns an Applicant who, while taxiing to take off, hit a runway threshold light at another small rural airport. A few months later, the same individual was involved in an alleged near-miss incident, at the same location while failing to conform to the pattern of traffic. These incidents led, respectively, to charges under CAR 602.01 and CAR 602.96(3).

At the Review Hearing, the Member upheld both charges, but reduced the length of the licence suspension.

With regard to the first charge, the Member found that the Applicant was taxiing closely behind another plane. When that plane suddenly stopped, the Applicant's plane, in part due to an unfortunate brake malfunction, veered to the right and hit the runway threshold light. The Member found that the Applicant was "attempting to rush" the take-off process, and that such conduct falls below the standard expected of a reasonable and prudent pilot.

The second charge resulted from the Applicant's conduct of a practice forced-landing procedure while a second aircraft was approaching the airport at the same time. The Member found the Applicant to have been unreasonable in not breaking off his training procedure in order to conform to the standard traffic pattern.

After considering various mitigating and aggravating factors, the Member reduced the total length of the licence suspension from 44 days to 21 days.

The first charge is a standard example of the workings of the negligence provisions of CAR 602.01. The charge was sustained because the evidence established that the Applicant's conduct fell below the standard of care expected of a reasonable pilot and it resulted in the endangerment of life or property.

The second charge was upheld largely because of the safety implications resulting from the Applicant's actions. As he was approaching the airport in a non-standard manner, it was incumbent on him to conform to the pattern of traffic formed by the other approaching aircraft. This, the Member implied, was what would be expected of a reasonable pilot in the same situation. That meant abandoning his training procedure, and by failing to do so, he engaged in negligent conduct.

Conclusion

The essence of negligence has been described as, "the omitting to do something that a reasonable person would do or the doing [of] something which a reasonable person would not do." The two cases discussed above illustrate how this basic principle is applied in aviation situations. It is quite often simply an exercise in common sense. In both cases, the pilots undertook actions that were ill-advised in the sense that they created situations of unnecessary risk. The risk was to others (as well as themselves) and to property. Given the gravity of the potential consequences of unnecessary risk within the aviation context, the decisions reached by the TATC are not surprising. While the exercise of common sense, prudence and the avoidance of negligent behaviour are important characteristics in all our activities, they are particularly so in the world of aviation. △

The *Aeronautics Act*—The Latest News!

by Franz Reinhardt, Director, Regulatory Services, Civil Aviation, Transport Canada

Bill C-6, an act to amend the *Aeronautics Act* and to make consequential amendments to other acts, was introduced in the House of Commons on April 27, 2006. The *Aeronautics Act* establishes the Minister of Transport's responsibility for the development, regulation and supervision of all matters connected with civil aeronautics and the responsibility of the Minister of National Defence with respect to aeronautics relating to defence.

The Act last underwent a major overhaul in 1985. Many of the amendments made at the time were aimed at enhancing the compliance and enforcement provisions of the Act, including the establishment of the Civil Aviation Tribunal (CAT), which was later converted into the multi-modal Transportation Appeal Tribunal of Canada (TATC). As a result of discussions with stakeholders, and in continuing efforts to enhance aviation safety and security, the following changes are proposed in Bill C-6.

The Department of Transport (TC) is re-shaping its regulatory programs to be more "data-driven" and to require aviation organizations to implement integrated management systems (IMS). These types of programs are increasingly required by the International Civil Aviation Organization (ICAO) and implemented by leading aviation nations. The enabling authority for the safety management systems (SMS) regulation is valid and authorized under the existing *Aeronautics Act*. However, for greater clarification and to provide the SMS framework with additional statutory protections from enforcement, as well as protection from access under the *Access to Information Act*, TC needed to expand the Minister's authority under the *Aeronautics Act*.

Amendments to the *Aeronautics Act* are also required to provide expanded regulatory authority over such issues as fatigue management and liability insurance. The current enabling authority related to fatigue management does not extend to all individuals who perform important safety functions, such as air traffic controllers. The current enabling authority related to liability insurance does not extend, for example, to airport operators. The amendments will also provide for the designation of industry bodies that establish standards for, and certify, their members, subject to appropriate safety oversight by TC.

In order to obtain as much safety data as possible, the amendments also propose the establishment of a voluntary non-punitive reporting program, allowing the reporting of safety-related information, without fear of reprisal or enforcement action taken against the reporting party.

Since the maximum level of penalties for non-compliance has not been updated since 1985, amendments are required not only to align them with similar legislation recently enacted, but also to act as a deterrent to future non-compliance. The proposed amendments will increase the maximum penalties for corporations in administrative and summary conviction proceedings (currently capped at $25,000) to $250,000 and $1 million, respectively.

Civilian sectors are now delivering some flight services to the Canadian Forces. These flights are considered "military," but as the *Aeronautics Act* is currently written, the Department of National Defence (DND) does not have all the authorities it needs to carry out a flight safety investigation that may involve civilians in a military aircraft occurrence. The proposed amendments would provide DND flight safety accident investigators with powers similar to those of civilian accident investigators under the *Canadian Transportation Accident Investigation and Safety Board Act* when investigating military aircraft accidents involving civilians. The amendments would also clarify the authorities of the Minister of Transport in relation to those of NAV CANADA under the *Civil Air Navigation Services Commercialization Act*.

For any additional information, please visit our Web site at www.tc.gc.ca/CivilAviation/RegServ/Affairs/menu.htm. △

Fuel Starvation Maule-4—Incorrect Fuel Caps

An Aviation Safety Information Letter from the Transportation Safety Board of Canada (TSB)

On September 30, 2004, a Maule-4 aircraft lost power while cruising at 1 200 ft. The pilot changed tanks and turned on the electric fuel pump, but power could not be restored and the aircraft was forced to land. As the field was too short, the aircraft sustained substantial damage when it hit a fence at the end of the landing roll and overturned. When the aircraft was recovered, the pilot owner was somewhat surprised that fuel remained in the right tank and very little was lost from the left tank after the aircraft had been inverted overnight. The type of cap installed includes an internal flapper valve, which closes, thereby retaining the fuel in the tanks.

Examination of all fuel tubing did not reveal any anomalies or restrictions. It was also outlined that the aircraft had a similar previous engine stoppage two years earlier. At that time, the aircraft was on skis over a snowy field and made a successful forced landing. Shortly after, the engine restarted and ran normally. Due to lack of other tangible factors, it was felt that it may have been caused by a fuel selector malfunction or positioning. The owner also recalls that whenever operating with the fuel selector on "both," the left tank always fed at a slower rate than the right. He further mentioned having heard air rushing into the tank when opening the left fuel cap for refuelling immediately after engine shutdown.

After the most recent occurrence, the owner was prompted to verify the adequacy of the venting system, which is done through the fuel caps (Figure 1). Air passage on the left fuel cap was found to be erratic; sometimes it would let the air through, but sometimes it would not. Information from the manufacturer indicates that this type of cap is only to be installed on aircraft having been modified with auxiliary wing tanks (located outboard on the wings), as the modification includes the plumbing for a different venting system.

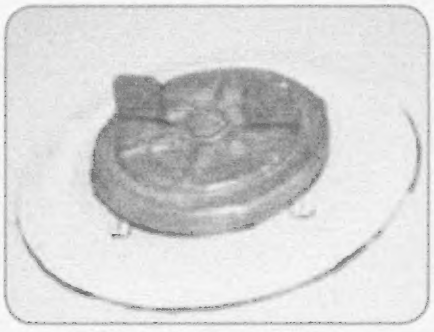


Figure 1: Non-probed fuel cap

The caps used on the occurrence aircraft, shown in Figure 1, had been ordered by the previous owner to replace the original caps to which a ram air probe is fitted to assure positive pressure within the fuel tanks (Figure 2). The order voucher indicated that non-leaking caps (non-probed caps) were requested. This was desired partly for aesthetic reasons and also because probed caps allowed fuel to leak out if the aircraft when it was parked on uneven ground. The order voucher included the aircraft serial number. The manufacturer forwarded the non-probed fuel caps without challenging whether the aircraft fuel system was original or it had been modified with auxiliary wing tanks. While the probed caps assure a positive pressure inside the fuel tanks, the air passage through the non-probed caps reduces the pressure within the tank below that of the ambient pressure.

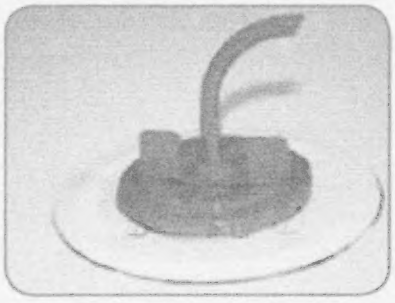


Figure 2: Probed fuel cap

Consequently, any blockage within the cap quickly results in stopping the fuel flow to the engine. As the fuel system includes a small header tank, switching tanks would normally restore the fuel flow, re-establishing power to the engine. Test bench trials on similar systems, operated by a skilled engine technician aware of the intended fuel starvation test, have demonstrated that it requires 30–45 seconds to restore full power following the engine stoppage.

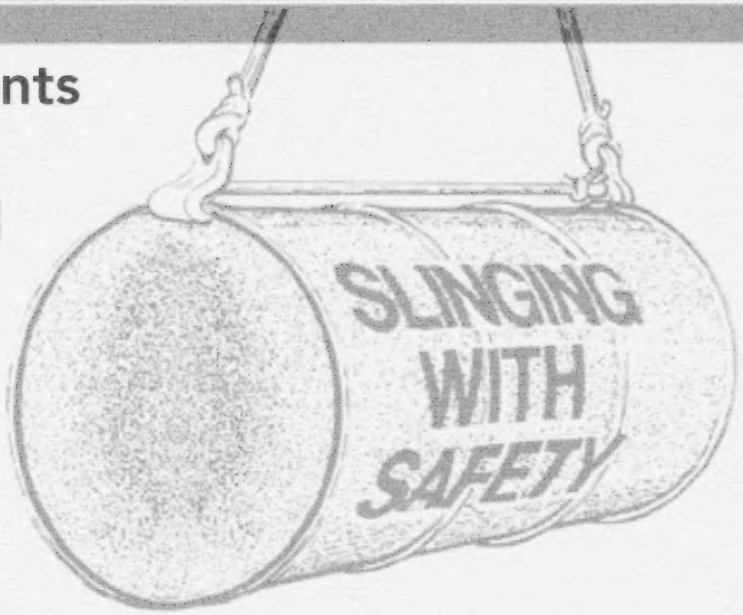
The investigation into this occurrence has raised a concern about the replacement of parts for different aircraft models, which would affect the airworthiness of the aircraft. The use of non-probed caps on an unmodified airframe has shown that venting is possible when the valve within the caps is working properly. However, as demonstrated in this occurrence, there is no alternate means of venting in case of malfunction. Any change to original aircraft status, regardless how small, must first be authorized by the manufacturer, unless it is approved via a supplementary type certificate (STC)—as these changes can and have created airworthiness disturbances. △

Transport Canada Transports Canada

TAKE FIVE...

for safety

Slinging accidents happen mostly to experienced pilots.



STAY ALERT!

Do these sound familiar?

- confined area
- awkward load
- marginal weather
- untrained groundcrew
- customer pressure
- tight schedule
- fatigue
- inadequate equipment
- uncertain field servicing

Canada

the safety problem...

Here's how accidents happen:

- getting pressured into a risky operation
- accepting hazards
- flying when fatigued
- lacking training for the task
- not sure of what's required
- operating in marginal weather
- ignoring laid-down procedures
- becoming distracted and not spotting a hazard

The major hazards:

- obstacles in the operating area
- snagged sling gear
- equipment failure
- deficient pad housekeeping
- surface condition: snow, soft spots, etc.
- incorrectly rigged load
- wind condition not known beforehand
- overloading

the safety team...

the PILOT

- follows procedures; no corner-cutting
- ensures everyone is thoroughly briefed
- watches for dangerous practices and reports them
- rejects a job exceeding his skill
- knows fatigue is cumulative and gets plenty of rest
- checks release mechanism and sling gear serviceability

the GROUNDCREW

- knows the hand signals and emergency procedures
- watches for hazards—and reports them
- rejects a task beyond his skill or knowledge
- insists on proper training in load preparation and handling

the CUSTOMER

- reasonable in demands; doesn't pressure pilot
- insists on safety first
- reports dangerous practices

the MANAGER

- allows for weather and equipment delays
- sends the right pilot with the right equipment
- insists the pilot is thoroughly briefed on the requirements
- supports the pilot against customer pressures
- demands compliance with operating manual
- provides proper training

Remember, 60% of slinging accidents occur during pick-up